VOL. 178 No. 2 AMERICAN FEBRUARY, 1953

Gas Journal

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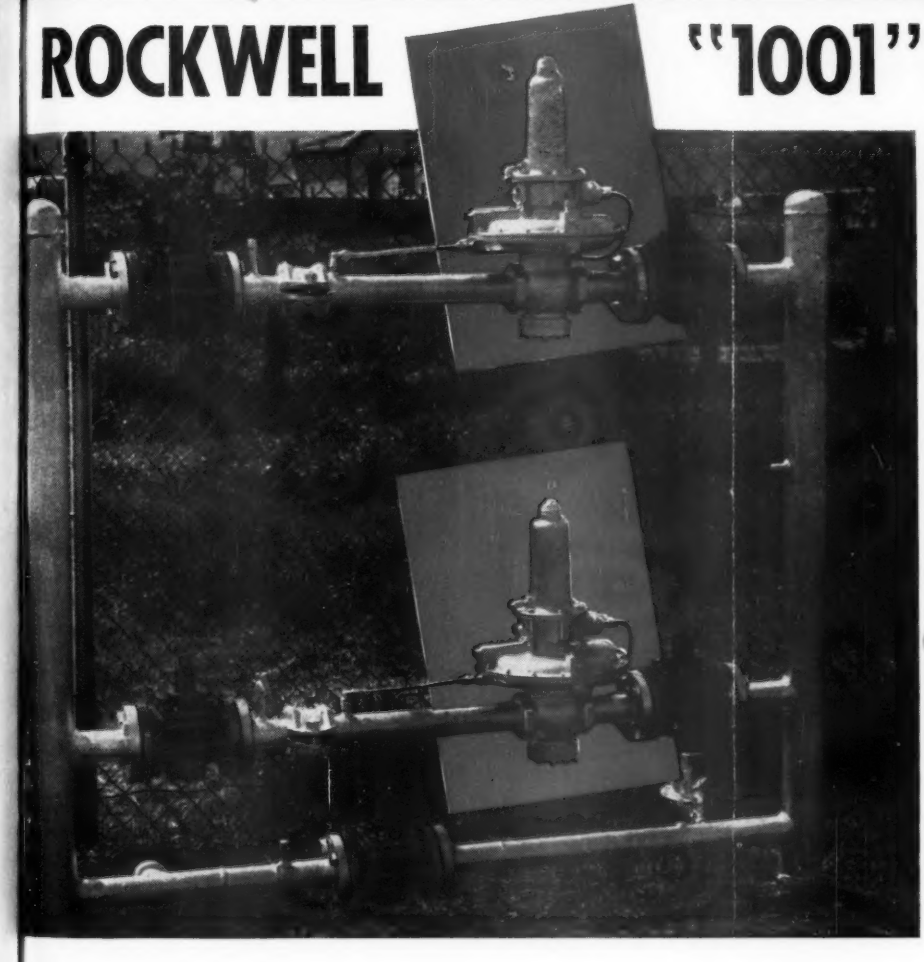
ROCKWELL "1001" REGULATORS



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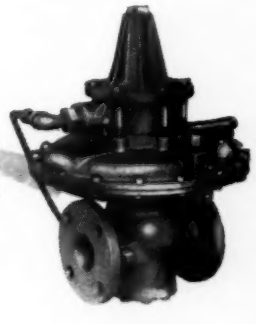
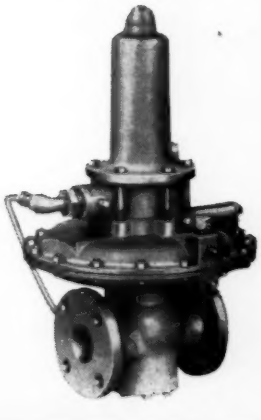


Standard Flange Type

Inlet 200 psi max.
Outlet range 2 oz. to 20 psi.



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AMERICAN Gas Journal
ESTABLISHED 1859

VOLUME 178 FEBRUARY 1953 NUMBER 2

This month...

Every now and then we are gently chided with the accusation that we pay no attention at all to letters from our readers; else why don't we print them in a separate column in the Journal with some imaginative title like "Letters from our Readers." On the general principle that we take everyone into our confidence, we will disclose the reasons: (1) until about a year or so ago we didn't get enough letters that had any significance to even justify a full column, (2) now that we do get them they are generally too replete with personal prejudices to permit of printing without the danger of a valued subscriber being tossed out on his compensation by management. Right or wrong, we should say that we still regard a letter as a private communication intended only for the eye and perhaps the heart of the person to whom it is addressed.

• • •

A recent graph received from William H. Adams, safety consultant for American Gas Association indicates that, on the basis of preliminary reports from the National Safety Council, the frequency rate of industrial accidents in the gas industry has dropped from nearly sixteen disabling injuries per million manhours in 1951 to fewer than ten in 1952. This is in comparison to a seventeen-year average, since 1935, of 15.46, and is by far the lowest in two decades for the gas industry. A tribute to the comparatively new safety-consciousness of the organization, and to the member utilities who have taken this vital matter under serious consideration.

• • •

A somewhat academic deviation from the usual treatises on corrosion is the article on page 31 by Dr. Carl G. Deuber on the bacterial background of that ever-foremost problem of pipeline and distribution main operators. For the purpose of the record it should be stated that the culprit in bacteriological corrosion is sporovibro desulfuricans whose full name may be hard to remember but whose ravages, says Dr. Deuber, are all too apparent.

Contents

Editorial: Stand Up and be Counted 13

PGW Drives Sleeve for a 30-Inch Main Under Busy Philadelphia Street 14

Eyes and Ears of Public Were Considered by Milwaukee Gas Light Company in Station Designs 16

Strategic Underground Gas Storage Promises Uninterrupted Peak-Period Service in Chicago 18

Inventors in Gas Industry are Urged to Study and Follow Patent Requirements—E. Wellford Mason 20

Variety of Gas Industry Responsibilities Shown in Recent Court Decisions—Leo T. Parker 22

Corporate Bond Market Expects Increase in Interest Rates —John F. Falvey 23

Submarine Crossing Gives Natural Gas Deepest Penetration of Northeast 26

American Gas Fundamentals: Natural Gas Reserves—Ernest E. Roth 27

Bacterial Attack on Buried Piping Regarded as Serious Cause of Rapid Corrosion—Carl G. Deuber 31

Federal Power Commission 32

News of the Gas Industry 37

New Bulletins 40

Men at Work 41

AMERICAN GAS MERCHANDISING..... 45

Chambers Adds Broiler-Burner Unit to Built-In Gas Cooking Equipment 46

Servel Opens on Broadway—Musical Show Gets to Hearts of Distributors and Dealers 47

Gas Appliance Industry News 48

Index to Advertisers 48

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ANOTHER EXAMPLE OF
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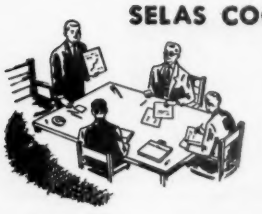

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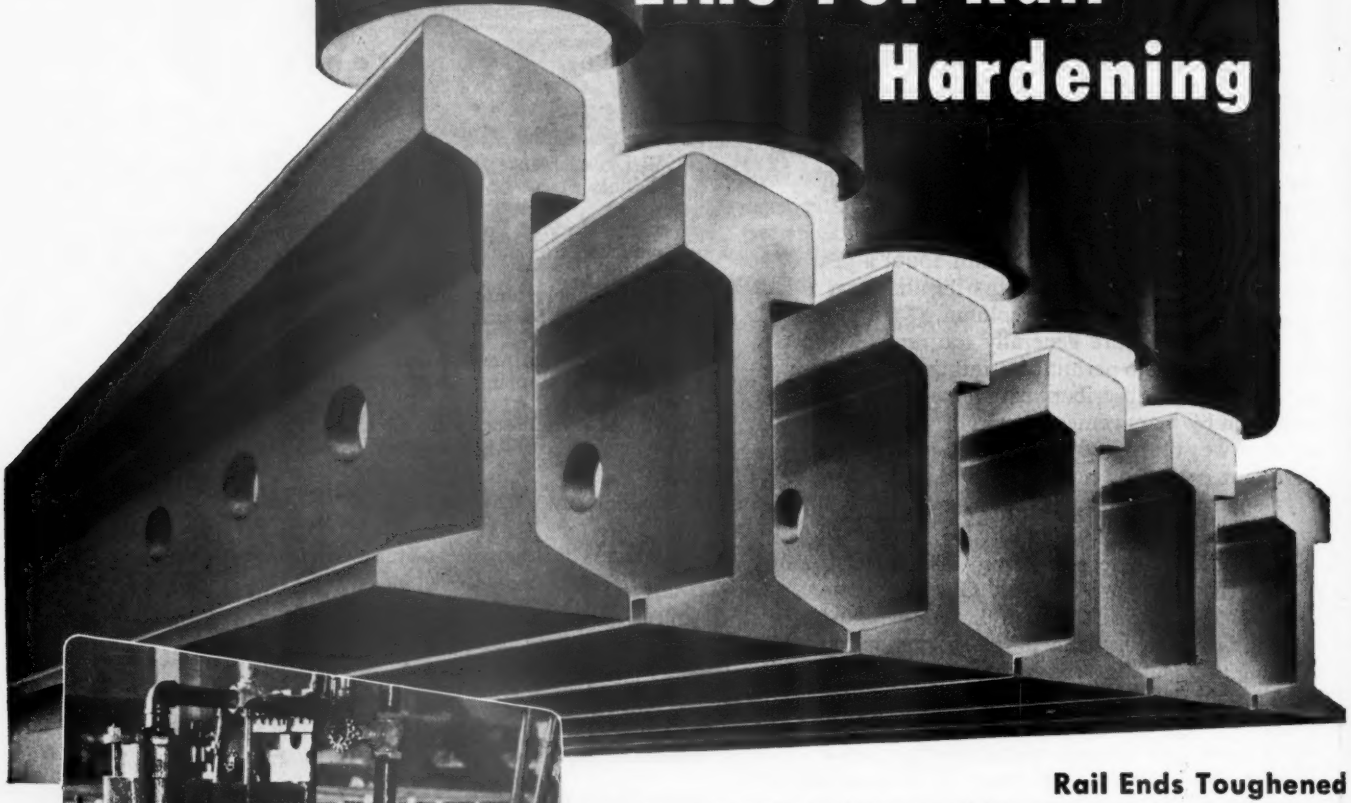

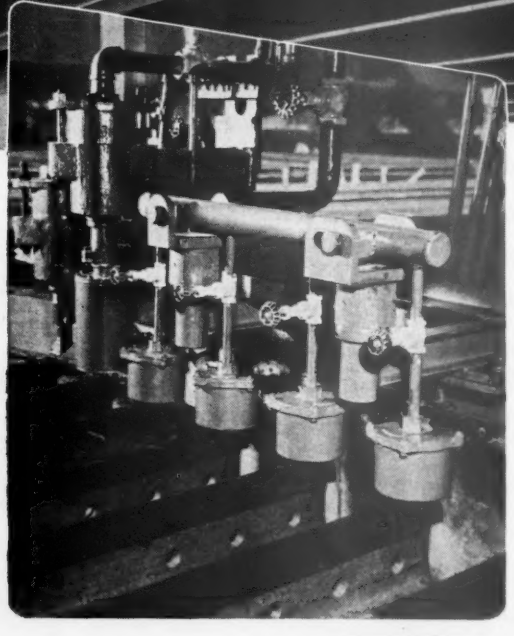

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Editorial:

Stand Up and be Counted

AT THE RISK of appearing over-dramatic, like a convention orator who has nothing much to say but is a regular Winston Churchill at saying it, we must register our profound and enthusiastic prediction that this year—almost, we might say, this month—is the time of decision for the gas industry.

It has been a long time coming and we, along with many others, have at times voiced our fretful impatience at the massive deliberation with which the movement has got rolling.

For nearly two years, committees representing the gas utility industry on the one hand and appliance manufacturers on the other have been working separately and jointly with the common objective of bringing about a rededication of the gas industry—of every factor from the smallest space heater manufacturer to the largest utility company—to its responsibilities and opportunities.

For the first time within the scope of our observation of the gas business, which at least has been lengthy if not always particularly penetrating, there has been evidenced from the outset the *will to do* on the parts of both utility and appliance leaders. In some quarters it might well be the determination of desperation; but now both sides recognize that there must be a complete and drastic overhauling of the whole industry attitude toward its concern for and approach to the public.

For the first time, too, the appliance group and the utilities have devoted their attention to self-examination, rather than to a breezy appraisal by each side of the strategic shortcomings of their allies in the other camp.

The result is a series of far-reaching and inclusive recommendations that are now being presented to the manufacturers by representatives of their own Gas Alliance Manufacturers Association and to gas companies by top utility executives speaking for American Gas Association.

Spelled out in detail, in a manner that would have been impossible a few years ago, are the specific things that each unit and factor must do if it is to cooperate in bringing about the renaissance of the gas industry that now seems within reach.

Recommendations in the fields of marketing, safety, servicing responsibility and utilization have all been agreed upon by a joint AGA-GAMA liaison committee. This is not the place for a categorical exposition of all the points covered. They require amplification and explanation in the terms of every company contacted. It is for this very reason that top executives in the industry have taken on the project for personal presentation to small groups of fellow executives with decision- and policy-making authority throughout the country.

This is not an assortment of wishful and intangible suggestions advanced vaguely for the "good of the industry" (in quotes). The recommendations are as concrete and as specific as they could possibly be made, and still remain general enough for universal application.

They say that the manufacturers must upgrade appliances and that the utilities must support those manufacturers that do this upgrading. They say that manufacturers must include in their prices enough money for adequate advertising and promotion, and that the utilities must take the lead in their own areas in translating that advertising and promotion into sales.

They say that appliance-research must be speedily reflected in terms of improved models, and that utilities must refrain from imposing unnecessary local requirements that make the excursion into new models dubious or even palpably unprofitable for the manufacturers.

They say that the utilities must accept the responsibility for the adjustment and servicing of appliances, and that manufacturers must make appliances that will need a minimum of adjustment and servicing.

Straight across the boards, the plan recognizes the necessity for a complete and continuing market analysis to which utilities, manufacturers and their two associations must all contribute data. And without market analysis no modern selling plan is worth its salt.

To fully implement this ambitious program, of which we have highlighted only a few items, will require prompt and positive and immediate action on the parts of both utilities and manufacturers. It is a program that calls first of all for the determination to do what has to be done, and then for the allocation of the dollars that will be required to accomplish the job.

Certainly, some of the major appliance makers, when they contemplate their last year's earning statements, must recognize that something drastic has to be done, even though each individual realizes that he cannot do it alone. Those who have launched ambitious promotional programs for 1953 must be facing the fact that their gaudy presentations will fall flat as a goose's foot in the area where the utility is lying down on the job of merchandising and promotion. Unless to curl-up-and-die is regarded as a desirable alternative, they have indeed little choice but to go along with a plan that is in their interests as much as the gas companies'.

And the gas companies, regarding the overpowering onrush of electrical competition, the proportionate decline of their life-saving base loads, and the dwindling public acceptance and appreciation of good gas service must feel the need for the most drastic form of remedial action. Unless they are resigned to a full-scale retreat to the cellar, with little left but the heating load, and from thence to issue forth with pathetic pleas for rate increases to bolster their sagging earnings, they too have no choice but to upgrade their vision, reaffirm their faith in their business, and put money and manpower into the fight to retain it and to build it.

There is a new era within sight of the entire gas industry. The gates are open wide, and the road has been mapped. It only remains for those who have the vigor and the determination to take the trip—to stand up and be counted.

Elliott Taylor

PGW Drives Sleeve for a 30-Inch Main Under Busy Philadelphia Street

Above is the hydraulically driven pipe pusher used for pushing the 42-foot pipe sleeve. Riding on a notched section of railroad track, it drove against a six-inch I-beam placed between the pusher and the 36-inch pipe. The beam distributed the power to the end of the sleeve.

Below is an interior view of the sleeve showing a workman in it and how dirt was pulled out on a dolly. At the top of the sleeve are the air and electric lines which provided light and filtered fresh air for the workmen. The 36-inch pipe provided adequate space for the workers.

IN the course of construction work, Philadelphia Gas Works Company is faced with many known and many unknown underground problems that are common to the older cities of the United States. Other underground installations of water mains, sewer piping and utility conduits constantly present buried obstacles to the planned routes for service extensions and enlargements.

While installing a three-mile stretch of a 30″ steel main in North Philadelphia recently, the PGW street division came to a crossing of a heavily traveled main artery with three parallel cast iron 60-inch water mains, a large sewer, not to mention the usual miscellany of electric and telephone conduits, and smaller water and gas mains. Those facilities had been constructed at varying elevations with no room for the installation of a 30″ main at the normal depth.

There was no choice but to go under all other construction.

Two excavations, each 18′ deep, were dug on either side of the crossing and back far enough to avoid any inter-

Traffic, Other Utilities and Public Convenience Not Interrupted

ference with the traffic on the main artery.

From that point, the plan that was followed called for the installation of a sleeve, 36″ in diameter, which would accommodate the 30″ main.

Sections of the sleeve, each 21′ long, were lowered to the working level. Then, a hydraulic pipe-pusher powered by a gasoline engine forced the sleeve through the ground. As the sleeve was pushed forward, a workman inside the sleeve removed the earth directly in front of the leading edge of the sleeve and loaded it to a dolly which was drawn back to the excavation and unloaded.

The pipe sleeve was provided with filtered and regulated fresh air for the workman and also with electric light. The lines that were necessary hung, out of the way, from the top of the sleeve.

The PGW street division reports that these workmen had little difficulty in maneuvering inside the 36″ sleeve.

The pipe-pusher mechanism was mounted on a railroad track with notches spaced every three inches for re-establishing a back-stop for the mechanism as the sleeve was pushed. An I-beam was positioned across the diameter of the sleeve to take the impact from the hydraulic mechanism and distribute the driving power.

As each 21″ section was advanced to its full depth, another section was welded and the driving operation was continued. This procedure was repeated until the underground excavation, inside the sleeve, had reached the opposite vertical excavation.

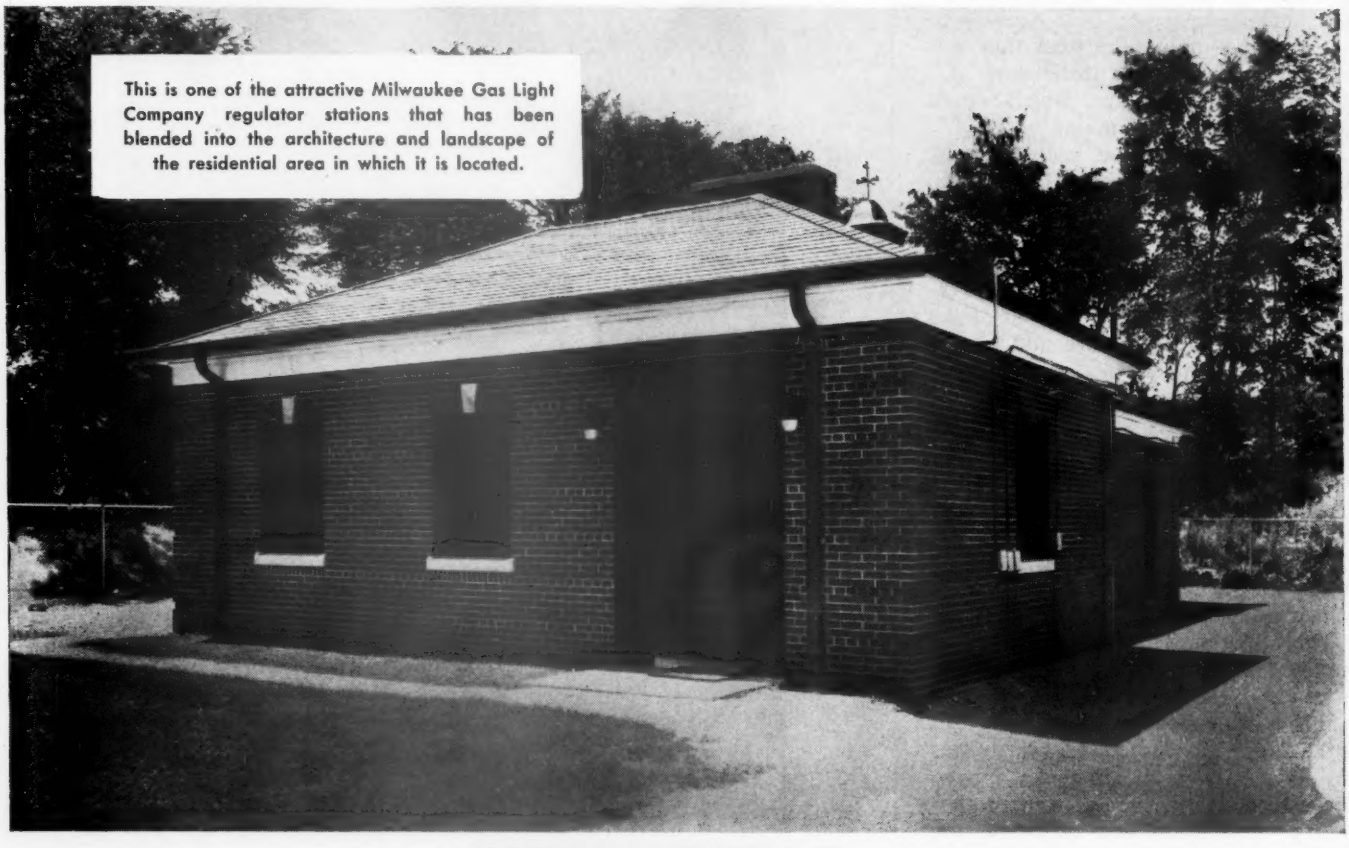
This procedure enabled PGW to make its 30″ installation without disrupting any of the previously installed facilities and also without interrupting the heavy flow of surface traffic.

In view of the difficulties that had to be considered in making this crossing, the tunnel technique including the excavating and shoring is regarded as not only being more economical but also having provided full consideration to public convenience while the work was being done.

Top—Dirt being removed from the dolly after it had been pulled back to the excavation from the worker inside the pipe. Below—The gasoline-driven power mechanism was located directly over the pipe pusher shown at the top of the opposite page.

Photos *The Philadelphia Gas Works News*

Eyes and Ears of Public Were Considered b Milv



This is one of the attractive Milwaukee Gas Light Company regulator stations that has been blended into the architecture and landscape of the residential area in which it is located.

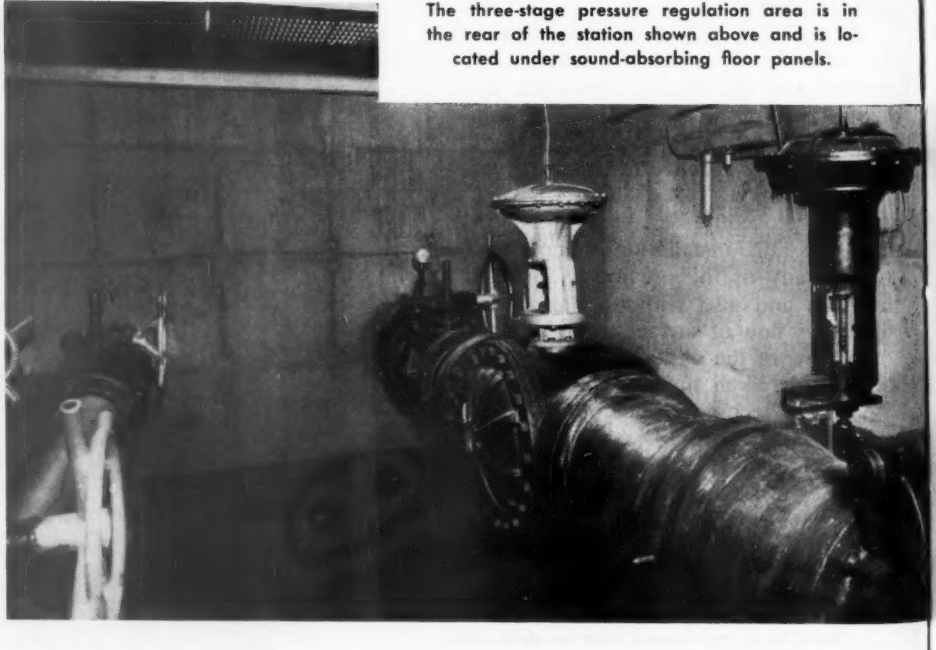
THE interests of the residents in the service area of Milwaukee Gas Light Company were very much in mind when the company planned for the construction of new city gate and regulator stations as part of the large-scale modernization program started in 1949.

Regulator stations located in residential districts were blended into the general character of the neighborhoods with architecture that resembles bungalows, completely surrounded by well-cared-for lawns.

While the construction of these stations was in conformance with zoning laws, Milwaukee Gas Light Company placed equal importance on the good public relations that would accrue from attractive buildings and noiseless operation.

The system was completed in February, 1950, and the objectives of the company have been fully attained. Public reaction to the stations has been excellent; the buildings and grounds are maintained attractively, there is no annoying noise to bother nearby residential neighbors.

The modernization program, of which these stations were a part, was given further impetus by the conversion of Milwaukee Gas Light Company from manufactured to natural gas.



The three-stage pressure regulation area is in the rear of the station shown above and is located under sound-absorbing floor panels.

One of the most interesting of the several unusual features incorporated in the construction of the new stations is the system of sliding doors which enclose the primary and secondary stages of regulation. These doors, located on opposite sides of the building, resemble garage doors and are made up of hinged panels which fold when the doors are raised, completely exposing the room on two sides.

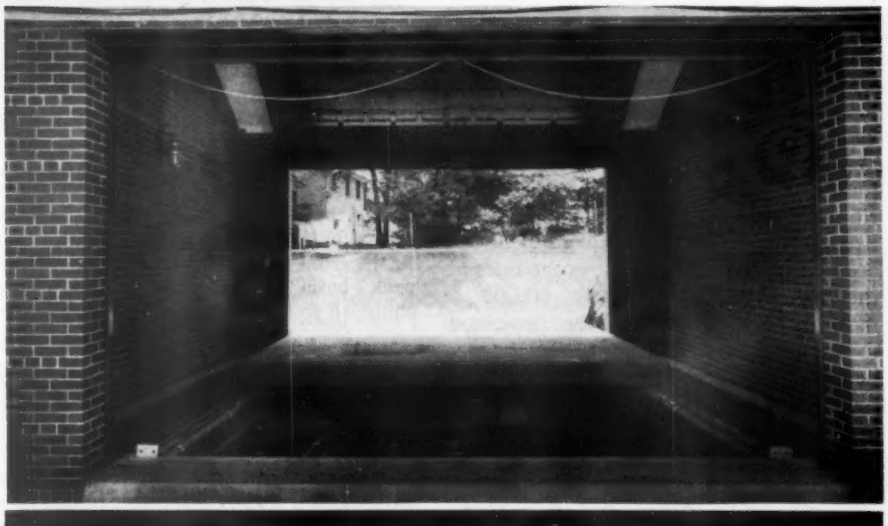
Regulators, meters, valves and piping

Milwaukee Gas Light Co. in Station Designs

Attractive and Noiseless Regulator Buildings Blended in Residential Areas

Left—Milwaukee Gas Light Company's city gate station is shown in the foreground with the scrubbers that are equipped with Nordstrom valves. The building at the left is the terminal of Michigan-Wisconsin Pipe Line Company.

Below—The hinged garage-type doors slide up and the sound absorbing steel floor panels roll out on rails to completely expose the secondary stage pressure regulation area.



are located under sound-proofed sliding floor panels, which are mounted on wheels that roll on rails extending approximately twenty feet outside the building.

The underside of the sliding steel floor panels is lined with acoustical fiber board that absorbs the shrill sound of gas flowing through governors at relatively high pressures. Fourteen-inch gratings extend along either side of the steel floor panels to permit air circulation through the pit when it is closed. Little sound escapes through these gratings.

All regulator stations in the Milwaukee system, except the city gate station, are unattended. The regulators are controlled remotely through a system extending from the central plant. For emergency purposes, by-pass pits have been installed outside the regulator stations. The city gate station is attended by four men who alternate shifts.

The city gate station receives gas from Michigan-Wisconsin Pipeline Company at about 250 psi and reduces the pressure to about 140 psi.

Gas is carried to three regulator sta-

(Continued on page 39)

Photos Rockwell Manufacturing Co.

Right—This is one of more than 100 low-pressure regulator pits, located throughout the Milwaukee system, now being converted to Rockwell pilot loading.

Strategic Underground Gas Storage Promise

Off-Peak Dump Sales by Related Pipelines Expected to be Eliminated

UNDERGROUND storage of gas for peak-period delivery, in areas that are located advantageously with respect to major markets, is now viewed as one of the most economical means of overcoming winter shortages and, at the same time, eliminating the necessity for the uneconomic sales of gas at dump rates during off-peak periods.

James F. Oates, Jr.

The space heating demand was portrayed frankly by James F. Oates, Jr., chairman of Natural Gas Storage Company of Illinois and of the related pipeline companies, speaking before The Investment Analysts Society of Chicago, last month.

With more than 200,000 single-family dwelling units now on the waiting lists of the distribution companies receiving gas from Texas-Illinois pipeline system, comprised of Natural Gas Pipeline Company of America and Texas Illinois Natural Gas Pipeline Company, Mr. Oates revealed that new applications are being received by those companies at the rate of approximately 10,000 a month. This trend has been projected to "a possible future additional house-heating load of approximately 1,000,000 dwelling units by 1960."

The Analysts' meeting was addressed also by Gardiner Symonds, president, Tennessee Gas Transmission Company, on the subject of production and transmission of natural gas.

Mr. Oates' comments on his company's new underground storage project follow:

In order to move in the direction of satisfying the needs of space heating applicants on our waiting list, the Texas Illinois Natural Gas Pipeline Company was organized in 1949 to build a new line 30 inches in diameter and more than 1,400 miles long, from the Gulf Coast area of Texas, at a cost of approximately $130 million. This new line was completed and began operations in December of 1951. Its initial daily capacity is 383 million cubic feet, and it is planned that this capacity will be increased by building more pumping stations when additional supplies of natural gas are obtained, resulting in an ultimate capacity of more than 500,000,000 cubic feet a day.

The new pipeline, even at its ultimate capacity, will not be enough to solve our supply problem.

The househeating demand

We had, as of January 1 of this year, a total of more than 122,000 Chicago families in single-family dwelling units on our waiting list for space heating service, and new applications are being received daily.

Every additional cubic foot of natural gas which is brought to market for the purpose of filling a space heating demand presents a problem greater than that presented by the preceding foot of gas. The space heating customers in the Chicago area provide only a 25 per cent annual load factor, which means that a house heating customer requires on an average day only 25 per cent of the amount that he will require on a peak day.

To help meet the problem of extreme seasonal fluctuations of the house heating load many utility companies like ourselves, not able to store the excess gas available during the period of low firm customer demand, have adopted the policy of selling such gas on a low rate interruptible or off-peak basis to industries or businesses equipped to burn gas as an alternative fuel.

Aware of need for conservation

But if a utility company were to commit itself permanently to sell gas for such lesser economic uses, its procedure would be contrary to the industry's long-range policies for the conservation of our natural gas reserves. If, however, instead of selling three-fourths of its annual supply as "dump" gas for lesser economic uses, a company were to provide adequate terminal storage for its excess gas, the reserves in the Southwest could supply more space heating customers without increasing the present pipeline capacities.

This situation led us some years ago to the consideration of possible methods of underground gas storage in order to best serve the public interest. As a result, another subsidiary, Natural Gas Storage Company of Illinois, was organized in 1951 to develop and operate large volume natural gas storage facilities.

Types of underground storage

There are three possible types of underground storage available for the consideration of a public utility or pipeline company which is seeking large storage capacity.

One method, on which some studies have been made, is the development of storage capacity in natural or artificial caverns, or in abandoned mines. The theory is that where capacity is to be provided by means of artificial caverns, the cavities can be mined out in a dense limestone or similar formation, marketing the stone as it is removed and sealing interior walls. Liquified petroleum gases are now being stored in similar artificial caverns or in space created by dissolving out suitable amounts of salt in deposit areas.

A second method, and the one most generally used in the industry, utilizes depleted or partially depleted gas or oil fields which lie within a reasonable distance from the utility company's market.

The third method of storage, and one which our consultants point out has certain advantages over other types of formations, utilizes suitable water-filled strata or aquifers located on closed anticlines or domes. The deep-lying reservoir stratum in this type of storage field is similar to that in which natural deposits of oil or gas are found but have never held oil or gas—only water.

Today there are more than 125 such underground fields in use across the nation, and new ones are being put into operation just as fast as the geologists and engineers can find adequate formations which are properly located.

Taken together, the fields now in operation and under development have a capacity of nearly one trillion cubic feet of gas, that is a volume sufficient to supply Chicago's needs for approximately ten years based upon the present load.

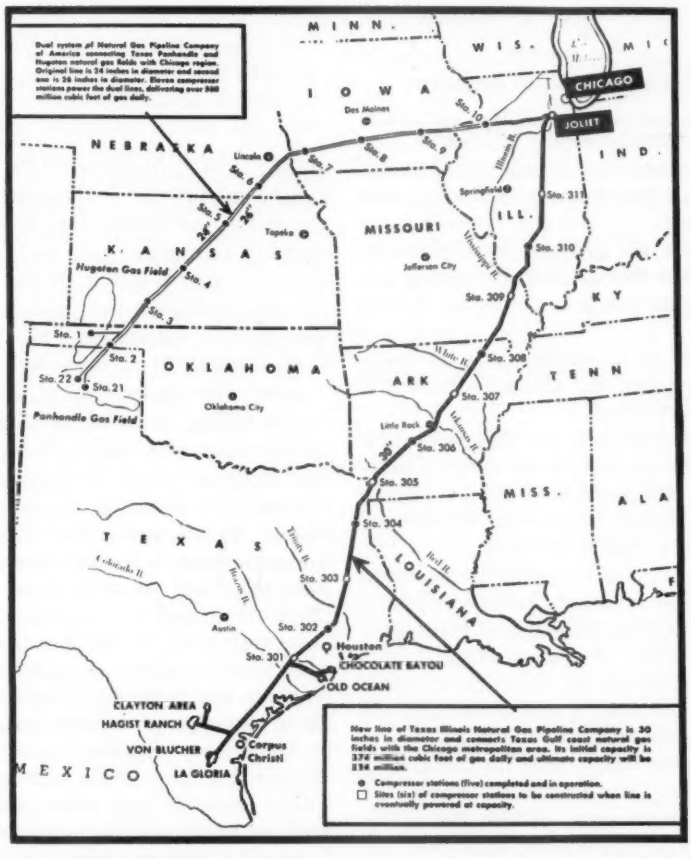
Considerations for storage area

Our study of the various storage possibilities led us to the conclusion that the most suitable one for our particular situation was situated in the northern part of the state near the town of Herscher. This reservoir will lie in a stratum of water-bearing sandstone which nature deposited during the Cambrian period more than 500-million years before our time. This formation, according to the experts, satisfies all of the requirements for a successful underground reservoir, which are

First, the formation must have within it a geologic trap large enough to hold the desired volume of gas, and be of such nature that gas will not migrate from it laterally.

Second, the solid strata above the reservoir must be sufficiently dense and impervious to prevent gas from migrating upward from the storage zone and being lost.

ise/ninterrupted Peak-Period Service in Chicago


Dual system of Natural Gas Pipeline Company of America connecting Texas Panhandle and Hugoton natural gas fields with Chicago region. Original line is 24 inches in diameter and second one is 26 inches in diameter. Eleven compressor stations power the dual lines, delivering over 860 million cubic feet of gas daily.
MINN.
WIS.
MICH.
IOWA
Des Moines
CHICAGO
JOLIET
NEBRASKA
Lincoln
IND.
Springfield
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MISSOURI
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KY
OKLAHOMA
ARK
TENN
Oklahoma City
Panhandle Gas Field
Little Rock
MISS.
ALA
TEXAS
LOUISIANA
Austin
Houston
CHOCOLATE BAYOU
OLD OCEAN
CLAYTON AREA
HAGIST RANCH
VON BLUCHER
Corpus Christi
LA GLORIA
MEXICO
New line of Texas Illinois Natural Gas Pipeline Company is 30 inches in diameter and connects Texas Gulf coast natural gas fields with the Chicago metropolitan area. Its initial capacity is 374 million cubic feet of gas daily and ultimate capacity will be 1.14 million.
Compressor stations (five) completed and in operation.
Sites (six) of compressor stations to be constructed when line is eventually powered at capacity.

This map shows the dual-pipeline system that brings natural gas from Texas to Chicago and adjacent areas in Illinois and Indiana. The northern pipeline is operated by Natural Gas Pipeline Company of America; the southern line by Texas Illinois Natural Gas Pipeline Company. The Herscher storage area, described by Mr. Oates, is 40 miles from the junction of the two lines at Joliet, Ill., and is 55 miles from the Chicago city limits.

Third, the reservoir bed, or stratum, must be porous enough to hold substantial volumes of gas and it must be sufficiently permeable for gas to move readily into and out of it as required; and also, that the reservoir be far enough below the earth's surface so gas can be safely retained at the pressures required. The suitability of a reservoir bed, provided it is adequate in other respects, depends on its porosity and permeability, in short its ability to absorb and later to release the gas with ease; and the effectiveness of a sealing bed depends on its impermeability and imperviousness.

Proximity to major markets

In addition to the above requirements, the storage reservoir must be close enough to the company's major consuming market to be practicable. This is an economic necessity because large volumes of gas must be released from storage during cold weather periods of peak customer demand, and the outgoing lines from the storage field must be short enough to require no more than a moderate construction investment. This requirement was also met in our situation in that the Chicago City Limits lie just 55 miles away and the terminals of the long-distance pipelines are only some 40 miles distant.

This storage reservoir . . . underlies an area of ground of approximately 25 square miles, and the top of the dome—that point nearest to the surface of the ground—is approximately 1,750 feet below the surface. The reservoir itself consists of highly porous and permeable sandstone a hundred feet thick; above this sandstone are layers of limestone about 200 feet thick, and below the reservoir is a bed of shale.

All of these findings indicate that this area has almost ideal characteristics and capacity. Indications are that it will have an effective storage capacity that will prove larger than any storage field now in use and a capacity to yield up the gas once it has been placed in storage that will be higher than any field in operation.

90 billion of ultimate capacity

We are counting on the reservoir ultimately holding at least 90 billion cubic feet of gas which may be withdrawn as needed. This gas capacity is in addition to an as yet undetermined volume of "cushion" gas.

Just for purposes of comparison, the Chicago customers of Peoples Gas in one year use the equivalent of slightly more than 100 billion cubic feet of 1000 Btu natural gas, and at full operation the Herscher field is expected to be capable of delivering a very impressive peak day's maximum of one and one-half billion cubic feet of gas from storage.

Such a maximum delivery from storage, when combined with the delivery capacity of our system's three long distance pipelines, would make available to the consuming public on peak days a volume which would be about two and one-half times the amount of gas which the Texas-to-Chicago region pipelines could deliver without the storage field's help.

Together, the long distance lines of Natural Gas Pipeline Company of America and Texas Illinois Natural Gas Pipeline Company now have a daily transmission capacity of 906,100,000 cubic feet.

The cushion gas, let me explain, is placed in the reservoir to remain throughout the life of the field as part of the capital investment. Our engineers have estimated that we might possibly require as much as 90 billion feet of cushion gas, which serves two purposes, namely: to exclude water from certain regions within the reservoir, and to provide the steady pressure needed to maintain the field's required deliverability.

The reservoir formation presently is filled with a salty artesian water which is under a normal hydrostatic pressure of slightly more than 700 pounds per square inch. When gas is injected into the top of the reservoir bed at pressures not to exceed 1,000 pounds per square inch, the water will be forced back along the perimeter of the region in which the gas is being stored (we call this the gas "bubble"), forming a lateral seal to prevent the gas from meandering from its trap.

Not all of our earlier problems lay within the fields of engineering and geology, however. A legal essential for the development of a storage field is the right of eminent domain permitting the storage company to obtain easement agreements for the perpetual right to store gas in the lower formations. Without this legal right, any single property owner in the storage area could obstruct the project or lay claim to, and, as has been done, even withdraw the gas from the storage zone.

Have right of eminent domain

Fortunately for the purposes of our Herscher project, the Sixty-seventh General Assembly of the Illinois legislature in 1951 enacted a law giving qualified utility com-

(Continued on page 34)

Inventors in Gas Industry Are Urged to Study and Follow Patent Requirements

by E. Wellford Mason

Patent Attorney

Selas Corporation of America

PRACTICALLY everyone has heard of patents. Most people, however, know very little more about them than that if you invent something and get a patent on it you will either make a million or lose your shirt. Neither of these is generally true.

It is the purpose of this article to tell something about what patents are, how you get them, and what you do with them. Patents are important considerations throughout the gas industry—from gas production or manufacture to the points of utilization in homes, business and industry.

Practically everything you wear or make and many things you do are patented, or were patented at one time. It is the knowledge that *a device or process is patented and therefore that you alone, or those that you permit to do so, can make, use or sell the device* that has started many businesses.

Patents create jobs by giving protection to risk capital so that the invention may be exploited commercially. They are also a reason for a large part of our technological development since a manufacturer will continue to strive for new products and to improve his old ones, and to get patents on them. His competitors will strive to make a better product by designing something to do a better job or costs less to manufacture and will not infringe existing patents.

It was truly said by Lincoln that "the patent system added the fuel of interest to the fire of genius."

The present patent system was started in 1836, and the law was completely revised in 1952. Patents were granted by the states, however, before the Union was formed, and the first Federal patent statute was passed in 1790. Over 2,600,000 patents have been granted to date. They relate to almost every conceivable subject.

What can be patented, how patents can be procured, and what you may do with them are strictly regulated by statute. The basis for our patent system is found in the Constitution, Article I, Section 8.

"The Congress shall have the power to promote the progress of science and the useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Note that the purpose is to promote science, and this is done by giving exclusive rights to the inventor for a limited time.

In order to implement this constitutional provision, the Congress passed a statute which reads:

"Whoever invents or discovers any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, . . ."

Patents are also issued to the inventor or discoverer of a new variety of plant, other than a tuber propagated plant, and to the inventor of a new, original and ornamental design for an article of manufacture. The patents that are usually referred to, however, are the ones for inventions rather than those for plants and designs. The same general rules apply to patents of each type, except that a design patent is for a shorter term than the others.

The application for a patent

If it is determined that your invention satisfies the requirements of law, a patent will be granted. This is sometimes termed a contract between the patentee and the government which gives the patentee the exclusive right for seventeen years to control the manufacture, sale and use of the thing patented. In return for this, the patentee tells in enough detail how the invention may be reproduced for a man skilled in the art to which the invention is related to practice it. At the end of the seventeen-year term, all rights are freely available to the public.

When it has been determined that the invention has enough commercial possibilities to justify the expense of procuring a patent, a study is usually made to determine if the invention is really new. Assuming that it is, the application is prepared.

This application must set forth the objects that the invention is to accomplish. It must also include a full, clear, concise and exact description of the best form of the invention which is then known. Other forms may also be included if the principles of the invention can be carried out in different ways. At the end of the application, there are one or more claims pointing out exactly the limits of the invention. If the invention can be illustrated, the application must also include a drawing. The application is accompanied by a filing fee of $30.00.

After the application is filed in the Patent Office, a part of the United States Department of Commerce, it is examined to determine if the invention is patentable and properly expressed in the claims. As a result of this examination, the application is frequently amended to overcome various objections that are made to it, and to cause the claims to point out distinctly the limits of the invention with respect to prior patents relating to the same field. Assuming that the invention is ultimately determined to be sufficiently different from prior devices in the same field, the application will be allowed. Then upon payment of a final fee of $30.00, the patent will issue. It usually requires from three to five years from the time the application is filed until the patent is granted.

Patent gives right to exclude

By issuing a patent, the government gives the patentee not the right to make the patented invention, but the right to *exclude others* from making, using or selling the invention in the United States or its territories for the seventeen-year period. You may not be able to manufacture under the patent, for example, because it is directed to an improvement on a device that is already patented, and upon which the patent has not expired. You cannot infringe an existing patent to build that device with an addition or in an improved manner. When the patent on the device expires, the device can be made, and the improvement can be added to it by the owner of the improvement patent. On the other hand, the owner of the existing patent is not free to add the improvement.

Before a new product is placed on the market, the manufacturer should determine that it is free of patent infringement, or make suitable arrangements with the owners of the patents that are

infringed. The best time to do this, of course, is before any tooling has taken place, and certainly before going into production.

Patents as property

Patents as property have certain peculiar attributes all their own. In the first place, a patent can only be granted to the inventor or inventors, or to someone that they authorize to receive it. There is no provision in the law whereby a patent can be applied for by a corporation or other employer of the inventor. It must be applied for in his name and the application must be signed by him personally. But like other property, they may be bought and sold.

Frequently by the terms of an employment contract, an employee will agree to turn over to his employer any inventions that he may make relating to the employer's business while he is so employed. As a result of such a contract, the inventor-employee will assign his application or the patent issuing from it to his employer. The latter is then the owner and can do as he sees fit with it.

An outright sale of a patent is termed an assignment. The price can be either a fixed sum or a percentage of the sale price, for example, of the patented devices that are made, or the owner can license others to make the patented device for whatever consideration may be satisfactory with him. The license may be exclusive or non-exclusive, and it may be for the entire country or any portion thereof.

Since anyone may make the device, when a patent expires, it is the wise patent owner who continues his research and development. By the time the patent has expired, he will have other and improved devices ready to be placed on the market, and if they have been patented, he will have the right to exclude others from their use.

Keep it secret?

The question of keeping an invention secret frequently arises. Is it better to keep the invention secret, or is it better to tell what the invention is and how to practice it and obtain patent protection? If the invention is kept secret, it will be difficult, if not impossible, to exploit commercially without giving the secret away. As soon as someone learns how to carry out the invention he is free to do so at any time, with no return to the inventor. On the other hand, even though the details of the invention are disclosed in a patent, only those permitted to do so by the inventor may copy it.

Between the time an application is filed and the time a patent issues, only those receiving authorization from the inventor may be informed of its contents. The examining corps of the Patent Office never discusses an application with anyone unless he can show that he has authority to do so.

As noted above, after the patent has issued, it is open to public inspection. For this reason, the files and search room of the Patent Office form one of the greatest scientific libraries in the world. A study of those files will give the history of almost every technical development from its infancy to the present day.

This source of information should be put to greater use. For example, before beginning a new development, study the patents that have been issued previously on the subject. The development can then continue where they left off without repeating work that has already been done. The study will also show what cannot be done as well as point out deficiencies of the prior art that may be profitably rectified.

Patents promote progress

There is no question but that patents have promoted the progress of science and the useful arts, and as long as our system of competitive enterprise holds out rewards for those things that are new and useful, inventions will be made, and patents for them will be issued.

Most industrial organizations or individuals do not conduct research and development primarily for the purpose of obtaining patents. They do it for business reasons, that is to say, they want to develop a new article that can be manufactured and sold at a profit. They could not afford the cost of research and development, however, if they were not able to obtain some protection for their inventions. This is the function of patents. For this reason, it is well to have some knowledge of whom they are issued to and what is necessary to obtain them.

According to the law, any person who has made an invention, and who has satisfied the other requirements of law, is entitled to receive a patent on it. One of these requirements is that the invention shall not have been in public use for more than one year prior to the time the application is filed. Another requirement is that the invention should not have been described in a printed publication in this or a foreign country more than a year prior to the date of the application, and the invention must have been made by the applicant.

What is an invention?

The question of what is an invention, however, frequently has the experts stumped. In the case where the invention is an improvement over something that has gone before, it is required that the improvement to be patentable must be such that it was not obvious to a person having ordinary skill in the art to which it pertains. The new apparatus or method may be a big improvement that has long been needed, and it may be a commercial success, but if it does not satisfy the rather nebulous requirements of *invention,* the originator is not entitled to a patent. What is *invention* must be decided on the facts in each case.

A patent may issue in the name of a single person if the invention was made by him alone, or it may issue in the names of more than one person if they jointly contributed something toward the invention. In the case where more than one person worked on a development that resulted in a patentable invention the question always arises as to whether one or more of the people should be named in the application. Situations of this type requiring a determination of whether an invention is sole (one person) or joint (more than one person) can usually be resolved without too much difficulty.

Many courts, including the United States Supreme Court, have ruled on this question. The person who conceived the invention and carried out or directed the carrying out of a reduction to practice is the inventor. A joint invention is the result of the work of more than one person, each contributing his efforts and having some share in the conception and perfecting of the idea.

An employee is entitled to his own inventions. If, however, the employee merely perfects the general arrangement and details of an invention, the general principle or plan of which was conceived by the employer, then the employer is considered the inventor. The employer, however, must do more than suggest the desirability of a certain result. At present, when a person is included by error as a joint inventor or a person is not properly included, the application can be amended to include the proper persons if the error arose without any deceptive intention.

Ownership is separate matter

The question of ownership of a patent is entirely separate from the question of inventorship. A patent can only issue in the name of the inventor, but it can issue to any one who has been authorized by the inventor to receive it.

The most difficult situation in which the determination of inventorship occurs is that which arises when more than one person has invented independently the same device or process. It happens, not infrequently, that more than one person is working at the same time on the solution of the same problem. Assume that both of them arrive at substantially the same solution and make an invention in so doing, and that both of them file a patent application on the invention. There is then more than one application in the Patent Office request-

(Continued on page 36)

Variety of Gas Industry Responsibilities Shown in Recent Court Decisions

by Leo T. Parker

Attorney at Law
Cincinnati, Ohio

FEW persons take all needed precautions to avoid expensive law suits, but a majority displays interest in accumulating legal knowledge to avoid adverse law suits and save money.

An official of a gas company suggested an article reviewing outstanding decisions affecting gas companies and municipal gas departments rendered by the higher courts during 1952.

"If someone breaks a gas line, or causes a leak, how can the financial loss to the gas corporation be determined so it can sue the guilty party and recover damages?"

Two months ago, a higher court held that the loss may be speculated or estimated.

It was shown that a road contractor, when grading a street, broke a gas company's gas main. No report of the break was made at this time, but a couple of months later the gas company's officials noticed that there was a sharp increase in its losses due to unaccounted-for gas. Upon investigation the gas company's employes discovered the break. Evidence was collected proving that it was made by the contractor. The gas company sued the contractor for damages. Wellmar Gas Company v. Dunn, 52 N.W. (2d) 225.

An expert testified for the gas company to the effect that while his estimates were not absolutely correct, as to the gas losses caused by the break, yet he estimated or speculated a loss of an average of 1,115 Mcf per month from the break.

The jury held the contractor liable to the gas company for the sales value of this amount of gas each month for the several months the leak remained undiscovered. The higher court approved the verdict, saying, "While not absolutely accurate his (expert) conclusions as to the losses bear a reasonably close relation to the actual loss sustained."

Law of explosions

Many readers have displayed special interest in avoidance of damage allowances where private property is damaged by blasting operations during installation of gas lines. Hence, a review of unusual higher court decisions on explosion law rendered within the past two months.

"What testimony must be given by the complaining property owner to justify a court to award damages?"

The jury may decide that a property owner is entitled to recover damages after listening to relevant testimony, including circumstantial evidence, which tends to prove that the injury was caused by negligence of the employee who set off the explosion.

It was shown that a company's employe exploded a 50 lb. charge of gelatin explosive, 686 feet from a good water well, in Stand v. Giles, 197 Fed. (2d) 290.

The jury held the company liable in $3,175.00 damages to the owner of the well on the circumstantial evidence that the well going dry could not have been caused, under the circumstances, by anything but the explosion. The higher court approved the verdict.

Relevant testimony

"Can a property owner recover damages for injury to his property by proving that blasting operations damaged other property?"

Last month a higher court decided this question in the affirmative.

A building owner sued a corporation for damages to his concrete building alleged to have been caused by an explosion of dynamite. Benson v. Weaver, 250 S.W. (2d) 770.

In subsequent litigation the higher court held that the building owner was entitled to prove that the blast had damaged other nearby concrete buildings. Testimony to this effect is sufficient to convince a jury that the blast caused injury and damage to all similar buildings in the immediate vicinity.

Safety appliances

"What is the law on gas companies furnishing safety appliances to employees? Can an employee recover damages for an injury caused by failure of the company to furnish him with such things as a safe working place, safety devices and appliances."

The law is well established that it is the legal duty of gas companies to provide as "reasonably" safe working place as the circumstances will permit. Furthermore, the companies are legally bound to know that the premises, machines, tools and appliances are free from apparent defects which are likely to cause injury to employees.

On the other hand, a gas company is not an "insurer" against injuries sustained by employees. If it can be shown to the satisfaction of the court that an injured employee was negligent in not taking the proper precautions to protect himself against injury, or that the danger was readily apparent to the employee, the company is not liable in damages.

This phase of the law was thoroughly considered by a higher court in the leading case of Richardson v. Southern Company, 139 S.E. 839. In this case an employee, who was engaged in loading rock was instructed by his foreman to break large rocks with a sledge hammer furnished him for that purpose. When he struck a rock with this hammer, a piece of the rock flew and hit him in the eye.

The employee sued for the damages alleging that the corporation failed to furnish him with goggles or a wire screen for the purpose of protecting his eyes and that such failure or negligence caused the injury, and rendered the company liable.

The court held the company not liable, because the danger of breaking rock without eye protectors is readily apparent to all workmen who, therefore, are contributorily negligent in subjecting themselves to the known hazard.

"Upon the facts of this case," the court said, "it cannot be held that it was the duty of the defendant (gas company) to furnish such goggles or wire screens to plaintiff (employee) for his protection while engaged in the work for which he was employed."

Can buy, sell and distribute gas

According to a late higher court decision a state law is valid which gives a board authority to buy and sell gas, make gas rates, eliminate competition and the like.

For example, in Welling v. Newberry Natural Gas Authority, 71 S.E. (2d) 7, the testimony showed that a state law empowered and authorized a board or authority to engage in the business of purchasing and selling natural gas. This was so because a county, not being situated on a main gas line, its officers decided that it would be proper to establish such a board or authority to build a transmission line from the main gas line to the county and municipality therein; arrange to purchase gas from the corporation which owned the main gas line; and resell it to the various cities in the counties.

In holding the state law valid, the

(Continued on page 42)

Corporate Bond Market Expects Increase in Interest Rates

by John F. Falvey

Financial Editor

THE corporate bond market has begun to gear itself to the expected increase in long term interest rates.

John F. Falvey

During the past month the yield on highest grade corporates has risen by seven basis points to a 3.04 per cent level, from the 2.97 per cent previously in evidence.

In its action the bond market has been guided by two factors. First of these was the recent increase in the Federal Reserve Bank rediscount rate to two per cent, from the 1.75 per cent which had been in effect since August 1950.

This action was taken by the Reserve Bank authorities in an effort to put the *quietus* on inflationary pressures resulting from the sharp increase last year in the amount of consumer credit outstanding. Individual borrowing rose by $3 billion in 1952, against only $500 million in 1951, to bring the total of such debt at the past year-end to $23.7 billion, for the highest level ever reached.

To all intents and purposes the recent rise in the rediscount rate may help set the stage for a three per cent long-term Government bond issue later this year.

Such a rate of interest is expected to be the minimum necessary to attract sufficient investor and institutional interest to Government bonds to enable a lengthening of maturity dates and replacement of present short-term borrowings by long-term obligations. With four-fifths of the Federal debt now maturing or redeemable by holders within a five-year span, the Treasury no sooner comes to market with a new issue than it has to consider additional financing. Lengthening of maturities will permit of a more realistic approach to the entire Government debt situation.

Assuming that rising interest rates are inevitable as private industry and the Government compete for funds, the question naturally arises as to just how high capital costs might go without impairing the ability of corporations to borrow on a basis sufficiently favorable to justify further expansion.

Any danger on this score, however, seems to be strictly long range in nature. Factors in the investment situation now are such, or appear to be such, that while interest rates may trend still higher, no early runaway trend is indicated.

As Halsey, Stuart & Company, Inc., has indicated in its year-end review of the bond market, the life insurance companies alone are increasing their assets at the rate of $5 billion annually. A decline, or perhaps even a leveling-off of industrial corporate financing, this important investment firm says, seemingly might induce the larger life companies to bid competitively in the market for whole new issues of corporate debt securities.

Yet the point might be made that participation of the large life insurance companies in direct bidding for entire issues might insure a better market for the securities in question by injecting greater competition into the bidding. But the development, per se, cannot change the basic underlying market factor, namely, the extent to which Treasury Department financing plans over the months ahead will put pressure on the market for corporate obligations.

In their recent market action all types of common stocks—industrial, railroad and public utility—have been marking time at a level just under the best reached for many months past. This may be considered a period of watchful waiting on the course the new Administration plans to pursue in eliminating waste and instilling some semblance of order in Government spending, for preparedness and otherwise. By the time these comments go to press the clue presumably will be given the market in President Eisenhower's 'State of the Union' message.

An interesting stock market development of the very recent past was the action of staid Yale University in departing from its traditional investment program and boosting considerably the proportion of its funds in common stocks. The reason is simple: smaller endowments and rising costs of operation have left the University no alternative but to put more of its endowment grants into equity shares.

Under the so-called 'Yale Plan,' the University's endowment money heretofore has been invested in set ratios of bonds and preferred and common stocks. The ratios have varied with gyra-

(Continued on page 43)

INDEX OF YIELDS : SELECTED UTILITIES STOCKS

	Jan. 1953	Dec. 1952	Nov. 1952	Oct. 1952	Sept. 1952	Aug. 1952	July 1952	June 1952	May 1952	Apr. 1952	Mar. 1952	Feb. 1952
Natural Gas Transmission Companies	4.04%	4.04%	4.14%	4.48%	4.44%	4.10%	4.01%	3.98%	4.05%	4.08%	4.03%	4.36%
Natural Gas Transmission & Distribution Companies	5.02	4.99	5.14	5.47	5.45	5.30	5.26	5.28	5.32	5.34	5.14	5.29
Manufactured & Mixed Gas Companies	4.87	4.83	5.00	5.04	4.80	4.70	4.89	4.84	5.06	5.13	4.99	5.18
Class "A" Electric Companies	5.08	5.10	5.20	5.40	5.39	5.40	5.49	5.60	5.54	5.65	5.51	5.61
Class "B" Electric Companies	5.19	5.08	5.19	5.47	5.42	5.46	5.51	5.55	5.57	5.61	5.48	5.70

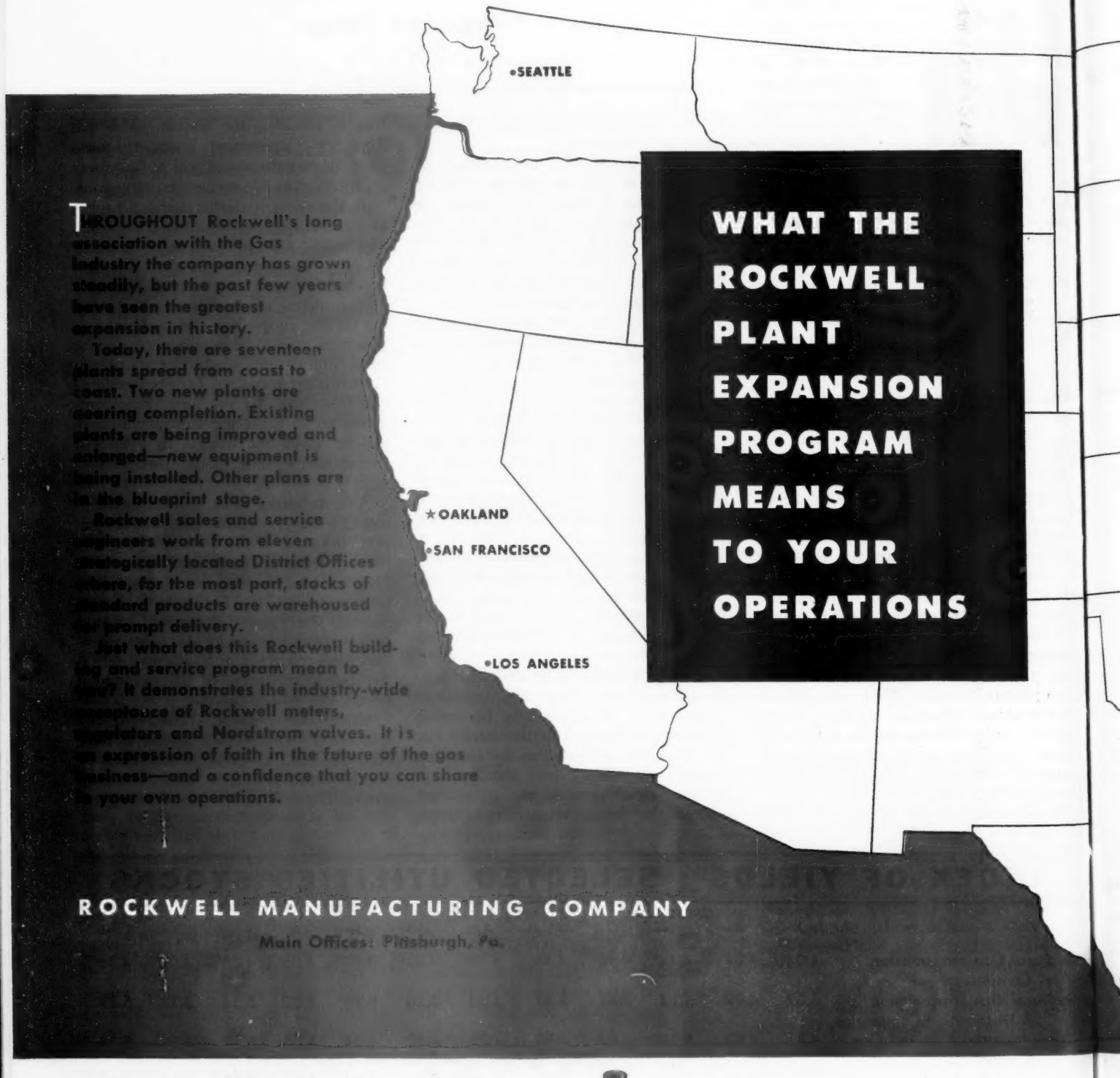
This is a straight arithmetical index of comparative yields obtainable on a selected group of gas and electric utility industry common stocks.

The companies comprising this index have been selected by the AMERICAN GAS JOURNAL as providing a representative cross-section of each industry, from the standpoint of geographical diversification and of the relative importance of the individual companies in their areas.

No effort has been made to weight the average to give effect to changes in capitalization or in dividend rates because the yields afforded on the issues reflect such changes. The index is designed to show the rate of return and not necessarily market movements on the stocks comprising it.

This index is compiled from: natural gas transmission companies, 5; natural gas transmission and distribution companies, 5; manufactured and mixed gas companies, 4; class "A" electric companies, 4; class "B" electric companies, 5.

ROCKWELL ...Growing with the



THROUGHOUT Rockwell's long association with the Gas Industry the company has grown steadily, but the past few years have seen the greatest expansion in history.

Today, there are seventeen plants spread from coast to coast. Two new plants are nearing completion. Existing plants are being improved and enlarged—new equipment is being installed. Other plans are in the blueprint stage.

Rockwell sales and service engineers work from eleven strategically located District Offices where, for the most part, stocks of standard products are warehoused for prompt delivery.

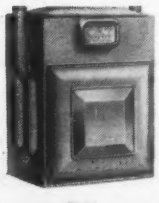
Just what does this Rockwell building and service program mean to you? It demonstrates the industry-wide acceptance of Rockwell meters, regulators and Nordstrom valves. It is an expression of faith in the future of the gas business—and a confidence that you can share in your own operations.

WHAT THE ROCKWELL PLANT EXPANSION PROGRAM MEANS TO YOUR OPERATIONS

ROCKWELL MANUFACTURING COMPANY

Main Offices: Pittsburgh, Pa.

ALUMINUM METERS


TIN METERS

CAST IRON METERS

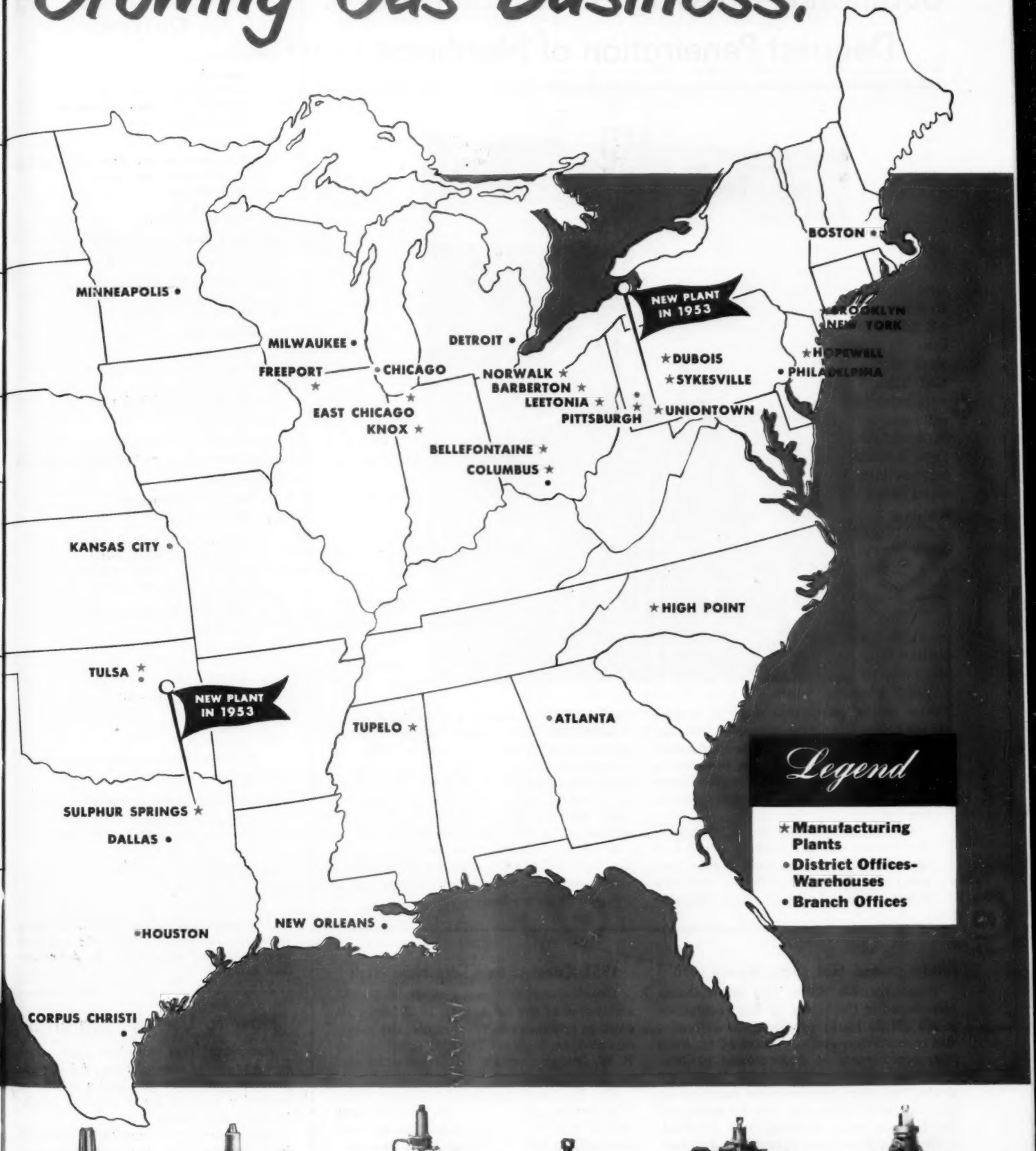
PRESSED STEL METERS

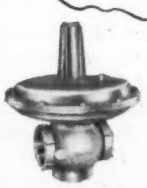
ORIFICE METERS

APPLIANCE REGULATORS

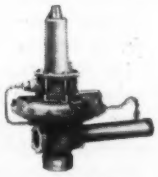
SERVICE REGULATORS

Growing Gas Business!





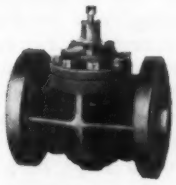
INDUSTRIAL REGULATORS



"1001" REGULATORS

BALANCED VALVE REGULATORS

NORDSTROM SERVICE COCK



NORDSTROM STANDARD VALVE

NORDSTROM HYPRESEAL VALVE

Submarine Crossing Gives Natural Gas Deepest Penetration of Northeast

A natural gas pipeline and river crossing recently constructed for Gloucester Gas Light Co., Mass., by United Engineers & Constructors, Inc., represents the most northeasterly penetration of natural gas in the United States. This terminal was placed in operation late last year.

An eight-inch pipeline from a Northeaster Gas Transmission Co. metering station runs approximately three and one-half miles, then enters the fishing port after a submarine crossing of the Annisquam River. The pipe for the 1,500-foot crossing was prefabricated in sections which were welded together as the sections were pulled into a dredged trench, by equipment located on the Gloucester-side of the river. Extensive fill work was necessary in approaches due to marshland and quicksand. The crossing construction was under subcontract by Merritt-Chapman & Scott Co.

A new gas handling plant for Gloucester Gas Light Co., a part of the overall project of introducing natural gas in its system, was designed by United Engineers.

Underground Gas Experiments in Bill

Representative Rains (D) of Alabama introduced in the House of Representatives a bill (H.R. 1601) proposing to authorize the construction and operation of facilities "for experiments in underground gasification to convert deposits of coal, lignite, oil shale, and other carbonaceous materials in situ to useful gases that can be employed for heat, or as a chemical raw material, with all facilities and accessories for production of the gases and their conversion to other products and for purification, storage, and transportation of the gases and their products. The products may be located on lands owned by the United States or . . . with consent of the owner, on private lands."

1952 Construction Sets New High

Construction contract awards in the 37 states east of the Rockies in 1952 broke all existing building records, topping the previous all-time high set in 1951, according to F. W. Dodge Corp., construction news and marketing specialists.

The 1952 total for the 37 states was $16,774,936,000 or 6 per cent greater than 1951's $15,751,131,000. Contributing significantly to the over-all total was the year-end heavy engineering figure of $3,412,368,000 which was up 25 per cent over 1951's comparative total.

Residential awards for 1952 totaled $6,667,504,000 or 7 per cent higher than in 1951. Nonresidential awards were $6,695,064,000, down 2 per cent from 1951.

American Gas Fundamentals OUTLINE

NATURAL GAS
- *Geology
- *Drilling and completion
- Methods of estimating reserves
- *Chemicals from gas

MANUFACTURED GASES
- *Coke oven gas; producer gas, blue gas; carbureted water gas
- *Reformed gas
- *Hi-Btu oil gas
- Interchangeability

LIQUEFIED PETROLEUM GASES
- *Sources, properties and uses

BASIC GAS LAWS
- *Perfect gases
- Supercompressibility

TRANSMISSION
- *Pipe lines
- *Corrosion and pipe protection
- *Compressor stations
- Hydrates and dehydration
- *Gas conditioning
- Flow formulae
- *Principles of orifice measurement
- Pipe coatings and protection methods

GAS STORAGE
- *Methods of storing gas

GAS DISTRIBUTION
- *System design and operation
- *Pressure regulation, part 1
- *Pressure regulation, part 2
- *Leak detection and control
- *Metering
- Measurement and accounting
- *Odorization
- Customer service
- Competitive fuels

GAS UTILIZATION
- *Principles of gas combustion
- Domestic
- Commercial
- Industrial
- *Principles of absorption refrigeration

CONVERSION PRACTICES

MANAGEMENT PROBLEMS AND POLICIES
- *Corporate structure
- *Public utility regulation
- *Public relations
- Theories of rate making
- Rights-of-way

*** Indicates chapters published since January 1, 1951; available without charge to new subscribers to American Gas Journal.**

How to Use the Material

American Gas Fundamentals *is a comprehensive compilation of basic gas facts to guide any gas utility employee toward a broader understanding of the industry as a whole.*

The series is designed to be removed from each current issue of AMERICAN GAS JOURNAL *and filed in a ring binder where it may be accumulated into a text book of permanent usefulness. Material should be filed under the major subject head appearing in the upper right hand box at the head of each chapter.*

Natural Gas Reserves

THE matter of estimating gas reserves is serious business to every factor and every segment of the gas industry, as well as to the gas consuming public whose members are dependent on this fuel in ever-increasing numbers, year after year.

Natural gas is a resource that, while it exists in enormous quantities, must always be regarded as irreplaceable once it has been exhausted, in any pool or producing area, as well as in the nation as a whole. Natural gas can be replaced at the consumption-end by manufactured gas, or in most instances by other fuels; but as far as production is concerned it cannot be renewed. The question of the amount, the availability and the geographical location of this supply thus looms as one of the foremost factors in considering the future of the industry.

Gas companies that have their own production, in other words that own the wells from which their supply is being drawn, are interested in the reserves because they must plan ahead against the time when this gas will be exhausted and make arrangements for new supplies from their own drilling, from gas purchased from pipeline companies, or from the manufacturing of gas from coal or oil.

Natural gas transmission companies have even a more vital stake in their gas reserves. The multi-million dollar investments in pipelines must always be predicated on two things, the volume of gas that can be put through the line in a given period, and how long the gas supply that feeds the line will last.

Until the amount of gas available for transmission through a line, and consequently for sale at the various terminal points, is known there is no way of estimating whether a reservoir will supply a small or a large market, or how long the supply will last. The common practice in financing a pipeline is to allow twenty years of operation for amortization of the investment in that line. Obviously, there must be a twenty-year supply of gas to be transported or the very purpose for which the line had been built would cease to exist before it had "paid out" to the bankers and investors who originally financed the project.

Gas distributing companies that purchase their natural gas supplies from the transporters also have a very pertinent interest in the amount of gas that will be available to their suppliers over an extended period. They must justify to their own satisfaction, and to the satisfaction of the regulatory bodies under whose jurisdiction they operate, any new expenditures contemplated for the extension of service into new areas, the expansion of distribution facilities to adequately care for the demand for gas, and the expense of changing over their systems from manufactured to straight natural or mixed gas.

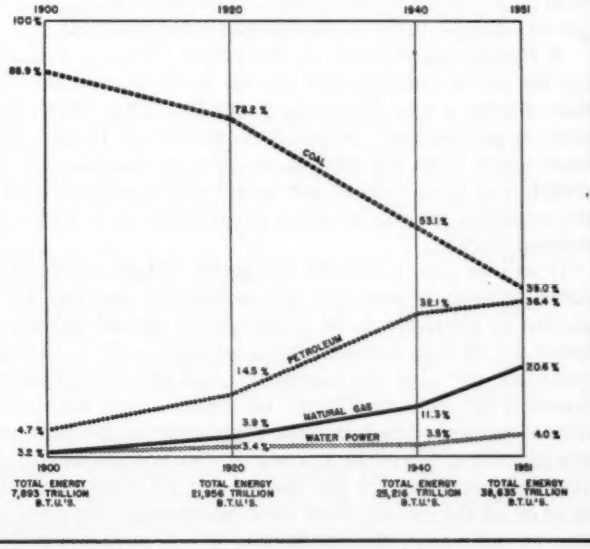
In recent years the amount of all energy reserves, of which natural gas is a component of ever increasing significance, has also become a subject of increasing national concern. Chart 1 indicates that in the past fifty years natural gas has risen from 3.2 per cent of the total of estimated available mineral fuels and water power in the United States to 20.6 per cent as of the end of 1951.

In the present-day turmoil in world affairs, it is generally conceded that available quick energy in the form of fuel is one of the keys to national survival. Disregarding the property interest of individuals and corporations, and their right under free enterprise to exploit them to their own maximum profit, it is now generally conceded that national fuel resources cannot be expended wastefully or in complete disregard for their greatest political and strategic value if the nation is to remain strong. Thus, the various regulatory bodies, most notably the Federal Power Commission which has jurisdiction over all pipelines and all natural gas moving in interstate commerce, looks carefully at the reserves in any given area before it grants a certificate of convenience and necessity which is, in effect, government approval of a pipeline project to carry gas into markets far-removed from the scene of production.

Meaning of Reserves

The meaning of the term reserves, as it is currently used in connection with natural gas, is the volume of natural gas available for delivery from any reservoir or combination of reservoirs. This does not mean the same thing as the total volume of gas actually in the ground. No gas pool or reservoir is ever drawn down until it is completely empty. Gas in the ground is always under some pressure,

Chart 1
PRINCIPAL SOURCES OF ENERGY
IN THE UNITED STATES
Percentage change—1900-1951



and it is this pressure that is normally relied on to lift it to the top of the well, and start it on its journey through the pipeline to the ultimate market. As gas is withdrawn from a reservoir that pressure tending to push it forth diminishes, and somewhere during the production period a point is reached where it is no longer economical to operate the field, even though it may have considerable volumes of gas left in it.

In a broad sense, the *natural gas reserves,* as far as individual producing and pipeline companies are concerned, means the *proved recoverable reserves,* and in recent years most estimates have been thus designated.

Technically speaking, reserves are more in the nature of approximations than exact measurements, since no system has ever been devised, or probably ever will be, that could calculate the amount of gas in any field to the last cubic foot. But the methods now employed are sufficiently accurate to enable companies to estimate how much gas they have available, and how long it will last at a given withdrawal-rate.

Although natural gas companies have been estimating their individual reserves for almost as long as natural gas has been piped to market, it is only within recent years that industry-wide studies have been made through the agency of a joint committee of American Gas Association and American Petroleum Institute. The first published report of this committee was in 1947. It is a very practical combination to have both the gas and oil industries cooperating in these studies because, in many instances, gas occurs in association with oil, and the gas is available for use as such, only to the extent and at a rate comparable to the withdrawal of the oil.

Standard Assumptions

One of the advantages that has accrued from the joint method of estimating has been the development of standard assumptions and definitions, and the adoption of uniform methods by the geologists responsible for the final figures.

The estimates of proved recoverable reserves of natural gas are now segregated into three classes: (1) *non-associated gas,* which is free gas not in contact with or dissolved in crude oil in the reservoir, (2) *associated gas* which is free gas in immediate contact but not in solution with or dissolved in the oil and (3) *dissolved gas,* which is gas in solution with the crude oil in the reservoir.

A fourth classification is sometimes added by considering the gas in underground storage in fields or areas other than where it was originally produced. This latter, however, is gas that has already been produced, in that it has been taken from the ground in some producing area and transferred to a natural gas reservoir in another part of the country, usually as close as possible to a large consuming market.

It will be seen from the foregoing classifications of reserves, that only one, the *non-associated gas,* can be regarded as available to be produced as needed within the limits set by the reservoir characteristics, state of development and physical characteristics, and also the limitations imposed by state regulatory or conservation authorities. *Associated gas,* which is most frequently in the form of a gas cap above the oil in a dome or reservoir, is usually not available until late in the life of the oil reservoir, when most or all the oil will have been produced. *Dissolved gas,* also an adjunct of the production of oil, is recoverable at a rate that is governed entirely by the requirements or demand for the crude oil from an oil-gas area.

The AGA and API committees are very careful to take current and future economic conditions into consideration in making their calculations. Only the gas that would be considered economically recoverable is included in their estimates. Thus, it is sometimes figured that a field might be abandoned when pressures were still quite high, if the cost of artificial pressure in the form of compressors to boost the gas into the lines would not be justified.

There are two common methods used in estimating gas reserves; they are known as the *Saturation* or *Pressure-Volume method* and the *Pressure Decline method.* Both methods are based on Boyles Law, which was explained in the chapter on Basic Gas Laws (*American Gas Fundamentals,* December 1951). Boyles Law states that the volume of any definite weight of gas at constant temperature decreases proportionately as the absolute pressure increases, and increases proportionately as the absolute pressure decreases.

Pressure-Volume Method

Thus, in theory, the measurement of gas in a field or well is comparatively simple. It is only required to learn the cubical contents of the area holding the gas and multiply it by the pressure to disclose the volume of gas that is there at that pressure.

However, when it comes to actual measurement the problem is not quite so simple. In the first place, it is difficult to define within anything like precise limits the underground area over which a reservoir extends; it is difficult to estimate its average thickness, and it is still another problem to arrive at the average porosity of the rock or sand in the reservoir.

As was pointed out in the chapter on Geology (*American Gas Fundamentals,* January 1951), all reservoir rock contains open pore spaces between the grains or particles of the rock. This void space, called porosity, ranges from three per cent of the entire bulk of rock in fine textured limestones and shales, to 35 per cent in certain sandstones. In reservoir rock, these spaces are filled with natural gas, oil or water. Therefore, the space available for gas in a gas reservoir is the total cubical content of reservoir rock, multiplied by the porosity of that rock. The fact that the extent and thickness of the reservoir must be known before the gas can be measured imposes limitations on absolute accuracy at the very outset.

Small fields, held by single companies, or by very few producers, are generally well-explored at an early stage in their lives. The operators are anxious to know how much gas they can expect to get from the field, since the planning of their future operations will be heavily weighted by this consideration. In large fields, however such as the Hugoton field in Texas, Oklahoma and Kansas, as well as the Panhandle field in Texas, the boundaries are still not precisely known, nor is there any definite foreknowledge of new gas deposits that may be discovered by deeper drilling.

The only sure way to determine the area of a reservoir would be to outline its outer periphery with dry holes, or in lensed sand by the marginal boundry as indicated by the thinning of the sand mass. This practice is not generally followed because the expense of outlining the field is most likely to be out of proportion to the value of the more precise measurement that this would make possible.

The thickness of reservoir rock is estimated from the

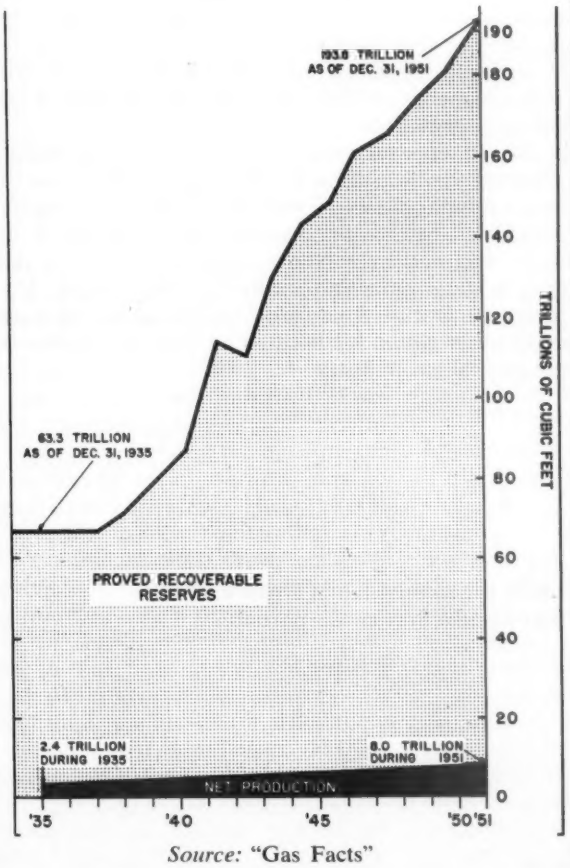
well records made during the original drilling operation. As explained under Drilling and Completion (*American Gas Fundamentals,* March 1951), well records or *Logs,* are kept on every well. These records, compiled from careful examinations of the cuttings brought up in the bailer, on a cable tool rig, or washed up in the mud flow from a rotary drilling operation, show the location and thickness of water sands, gas sands and oil sands, and the nature, character and thickness of the beds penetrated in reaching them.

Although well logs give good records of the thickness of the sands in individual wells, they constitute no absolute assurance that the stratum is uniform between wells. Here again, the question of the geologist's judgment enters into the estimate and he must in the final analysis set some figure in feet that he regards as reasonably close to the average thickness of the reservoir to be measured. Electric well-logging is also used extensively in determining the thickness of formations and their general characteristics. The porosity of a reservoir is most frequently determined from an analysis of cores of the sand.

The porosity of rock may also vary from one well to another, but if several wells in a given area are tested a good average can be established. Connate water must also be taken into consideration. This is the water that was deposited in the sands in an early geological era, and has not since existed as surface water or atmospheric moisture. Connate water, when present, occupies part of the pore space that would otherwise be presumed to be filled with gas or oil.

The volume of gas in cubic feet in a field is the total cubic volume of the reservoir, times the porosity, multiplied by the absolute pressure and divided by the pressure base.

Chart 2
PROVED RECOVERABLE RESERVES AND NET PRODUCTION OF NATURAL GAS
United States—1935-1951



Source: "Gas Facts"

Sample Calculation

Let us work out a sample calculation of a reservoir that is ten miles square, or contains 100 square miles, with the gas sand of 25 per cent porosity, twenty feet thick.

First, we find the cubic volume of the reservoir. At 640 acres to the square mile, and 43,560 square feet to the acre, the area would be 640 x 100 x 43,560 or 2,787,840,000 square feet. This times 20 would equal 55,756,800,000 cubic feet of reservoir. Take 25 per cent of this, as the porosity factor, and the result will be 55,756,800,000 x .25 or 13,939,200,000 cubic feet available for gas.

The pressure of gas in the reservoir will have been calculated from the well-head pressures; or from bottom hole pressure taken electrically. We will assume it to be 1,500 pounds gauge, or 1,514.5 pounds absolute. The absolute pressure is arrived at by adding the atmospheric pressure to the gauge pressure. We will use the atmospheric pressure as the pressure base, since we want to measure the gas in terms of how many cubic feet there would be at or near atmospheric pressure, rather than under the 1,500 pounds pressure that prevails in the well.

Then the amount of gas present would be:

$$13{,}939{,}200{,}000 \times \frac{1{,}514.5}{14.5} = 1{,}455{,}925{,}406{,}842$$

or, in round numbers, 1,455 billion cubic feet of gas.

In the case of exceptionally deep wells, where high temperatures are encountered it is sometimes desirable to correct the estimate for temperature in accordance with the principle of Charles Law of perfect gases. Charles Law states that the volume of a definite weight of gas under constant pressure increases proportionately as the absolute temperature increases, and decreases proportionately as the absolute temperature decreases. Absolute temperature, as was explained in the chapter on Perfect Gases, is the temperature reckoned from *absolute zero.* Since this is approximately —460°F, the absolute temperature is arrived at by adding 460 to the temperature given in any problem.

In their estimates of proved recoverable reserves the AGA-API committees calculate volumes at a pressure base of 14.65 pounds per square inch absolute, and at a standard temperature of 60° Farenheit. Therefore, if gas in the ground is at a temperature higher than 60°F, the calculated volume would be higher than the actual volume unless corrected for temperature.

In the above example 1,455 billion cubic feet is the correct answer only if the gas in the well or reservoir is at 60°F. Assuming the well-temperature were 100°F, then the above volume could be corrected for temperature as follows:

1,455 billion is to X as (460 + 100) is to (460 + 60)

Therefore 560 X equals 1,455 times 520; and X, the volume at the new temperature, is, in round numbers, 1,350 billion cubic feet.

Measurement by Pressure Decline

The pressure decline method of measuring or estimating reserves in any given reservoir involves the same Boyles Law with which we are already acquainted. Here, an accurate reading of the reservoir pressure is made at the beginning of a withdrawal period. A volume of gas is taken out, accurately measured, and the pressure taken at the end of the withdrawal. Gas must be withdrawn in considerable volume between the first and the final readings if the field is a big one, because enough has to be taken out to cause a decrease in pressure that can be measured accurately. Thus, if 100,000,000 cubic feet were taken out of a reservoir, and if that withdrawal lowered the absolute pressure of the gas left in the ground by ten per cent, we would know that the sand or the reservoir had 90 per cent of the gas left in place, or 900,000,000 cubic feet.

This is of course an oversimplified example, as far as actual practice is concerned. The effects of temperature and the deviation from Boyles Law due to supercompressibility might have to be taken into consideration. Also if edge-water were present and moving into the field some allowance would be made for that, since if the water moved in fast enough it could theoretically prevent any pressure drop at all.

Once the volume of gas remaining in the ground has been estimated, there again arises the question of deciding how much of it can be recovered economically. Since these questions are as much related to the economics of gas company and gas industry operation as they are to technical computations and gas laws, it follows that the judgment of the estimators and their understanding of management policies present and contemplated, are essential factors in arriving at the final results, the so-called proved recoverable gas reserves.

National Estimates

Interest in natural gas reserves has long graduated out of the class of local concern only to individual companies. The rapid expansion of transmission lines, their tendency to interconnect and integrate has made the problem increasingly a national one. It is for that reason that the scattered estimates once made have in recent years been coordinated under the leadership of the national gas and petroleum associations.

Although industry leaders do not scoff at conservation of natural gas, they are no longer impressed by the periodic alarms sounded in the past that have attempted to prove that reserves were in imminent danger of exhaustion within a few years or at best one or two decades.

One of the earliest estimates of natural gas reserves on a national scale was prepared in 1919 by the United States Geological Survey. According to that estimate, the country had originally a total supply of between 50 and 75 trillion cubic feet, recoverable and unrecoverable, of which eleven trillion cubic feet had already been marketed, 25 to 35 trillion had been lost, leaving only between five and 15 trillion feet in the ground. Yet, during 1951 alone, the addition to the estimated reserves aggregated more than sixteen trillion cubic feet, and despite a record production of nearly eight trillion cubic feet for the year, the remaining estimated proved recoverable reserves were more than eight trillion feet greater at the end of the year than they had been twelve months before.

Chart 2 provides a graphic illustration of the ratio at which the natural gas reserves have increased in comparison to the annual withdrawals. At the present rate of consumption our proved reserves of natural gas are equivalent to about a 25 year supply, as compared with an indicated nineteen-year supply of natural gas liquids and a thirteen-year supply of crude oil.

As the unending geological exploration of the underground regions continues, and as the geological data accumulated by individual companies and appraisers is assembled into formation analyses and transferred to structural maps, the horizons and fields of both gas and oil production become more clearly defined. Flank drilling on the outskirts of existing and known fields has resulted in the discovery of unknown stratigraphic traps. Drilling to greater depths in the search for oil has resulted in the discovery of a higher proportion of additional gas than of oil in the deeper formations.

Therefore it appears, and many prominent geologists agree, that on the basis of new knowledge being accumulated every month and every year, our natural gas supply will extend well beyond the present century. Suffice it to say that so long as the reserves do increase faster than the withdrawals, there can be no predictable end in sight. The present-day student of *American Gas Fundamentals* may rest assured that within his lifetime, at least, there always will be a natural gas industry.

This chapter on Natural Gas Reserves was prepared under the supervision of Ernest E. Roth, vice president and chief geologist, Columbia Gas System Service Corporation

Bacterial Attack on Buried Piping Regarded As Serious Cause of Rapid Corrosion

by Carl G. Deuber, Ph.D.
Director
Deuber Laboratories

BACTERIA and gas pipes at first may appear to be remotely connected ideas. Yet when there is an association of certain bacteria in certain poorly drained soils and a ferrous metal pipe system present the latter is likely to be corrosively deteriorating at a rapid rate by bacterial action. This type of damage is not dramatic like a ship's anchor yanking an underwater pipeline out of position but the aggregate deterioration is far greater. It is widespread, continuous and exceedingly costly.

At present this form of corrosion does not appear on the leak records of many underground pipe systems in the United States. This is not because bacterial corrosion is rare but rather because its symptoms *have not been recognized and properly identified.*

The incidence of bacterial corrosion is likely to be attributed to the convenient and general category of soil corrosion. In view of these facts, no estimates will be attempted of the extent and magnitude of the losses by bacterial action. It is more significant to set down some of the known facts of bacterial corrosion so that an increasing number of corrosion engineers may apply the principles and methods of preventive measures.

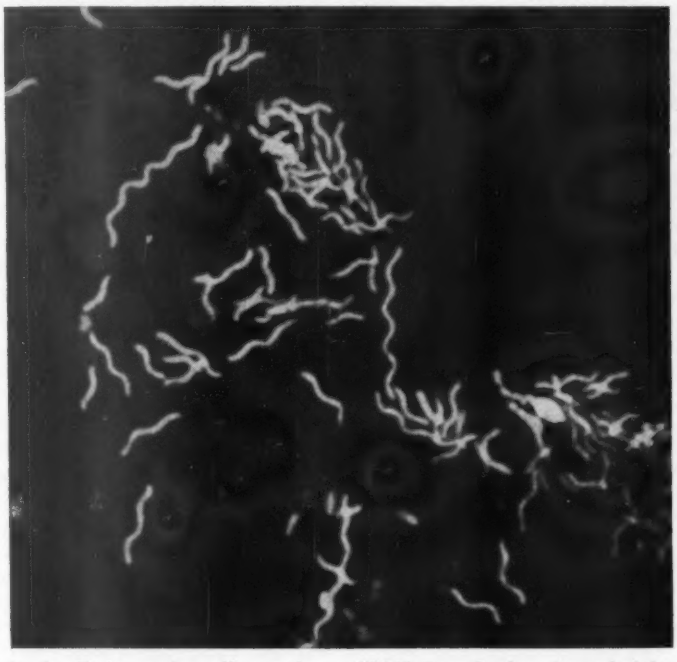
First considered in 1934

Bacterial corrosion is not new. However, it was 1934 before a Dutch corrosion engineer correlated the activities of certain bacteria with a serious form of underground corrosion. This concept was brought to the United States in 1937. Subsequent work shows bacterial corrosion to be intensive in its deteriorating action and widely distributed.

One of the large public utility companies in the East made a statistical analysis of test data at excavations on its underground gas lines with the finding that bacterial corrosion accounted for 81 per cent of the cases of severe corrosion, 54 per cent of the cases of moderate corrosion and 46 per cent of the cases of slight corrosion.

The principal bacteria involved are sulfate-reducers—bacteria that reduce sulfate to sulfide. The latter reacts with dissolved iron or metallic iron to form black insoluble iron sulfide. These bacteria are responsible for the large amounts of sulfide in the Black Sea and most of the iron sulfide in the black muds of ocean sediments and tidal basins. They occur in many soils, particularly the heavier, poorly drained soils, in bogs, oil well water and in some thermal springs.

CELLS OF BACTERIA INVOLVED IN PIPE CORROSION



Sporovibrio desulfuricans, the sulfate reducing bacteria. Magnification is approximately X1660. From Starkey, Journal of the American Water Works Association, v. 37, no. 10, p. 969.

Sporovibrio desulfuricans

These bacteria bear the name *Sporovibrio desulfuricans* since they are spore-forming vibrios, that is, occurring as motile small curved rods or in spiral chains. The reduction of sulfate compounds occurs in environments lacking free oxygen or where the oxygen concentrations are abnormally low.

The discovery of the part played by bacteria in the corrosion of iron came about with studies of the severely corrosive diked lands of Holland. Cast iron pipes in these black, low-lying, poorly drained soils were severely attacked by a slabbing type of corrosion. At first, this was attributed to soil acids and the hydrogen sulfide present. However, subsequent study revealed that these explanations were inadequate and incorrect. The soils were mostly neutral or near-neutral in reaction. But the corrosion products were high in iron sulfide which suggested that it might have its origin from the bacteria that produce hydrogen sulfide. The sulfate-reducing bacteria populations in these soils were known to be large. At times the dank, disagreeable odor of hydrogen sulfide is quite obvious from some of these areas.

Bacteria take up hydrogen

In these poorly aerated soils it would be expected that the iron would remain passive due to the presence of a film of hydrogen. But in the living activities of the sulfate-reducing bacteria hydrogen is taken up. This results in a depolarization of cathodic hydrogen at the metal surface. With removal of the cathodic hydrogen and its oxidation, at the expense of sulfate which is reduced to sulfide, the corrosion reactions are accelerated. The bacteria therefore serve as de-

(Continued on page 35)

FEDERAL POWER COMMISSION

Operating and revenue data—November 1952

Operating revenues of natural gas companies reporting to the Commission totaled $176,009,405 in November of 1952, the latest month for which figures are available. This includes an increase of 14.5 per cent over November 1951 receipts. For the twelve months ended November 30, 1952, revenues aggregated $1,838,184,806 or 15.9 per cent higher than in the twelve months ended November 30, 1951.

Gas utility operating income for November, 1952, amounted to $25,168,208, up 13.1 per cent from November of last year. For the twelve months period, gas utility operating income had an increase of 8.9 per cent over the comparable period ended in 1951.

Net gas utility plant of the reporting companies aggregated $4,658,619,884 on November 30, 1952, up $549,955,861, or 13.4 per cent over the report for a year ago.

Gas operating revenue deductions during November, 1952, amounted to $150,998,471, an increase of 14.7 per cent. Of this total, operating expenses accounted for $117,841,454; depreciation, $13,615,160; and taxes, $19,541,857.

Gas sales to ultimate consumers during the month increased 10.6 per cent over November, 1951.

Net income of the companies for November, 1952, was $18,299,040, up 8.5 per cent from November, 1951. For the twelve months ended November, 1952, net income of $202,877,546 represented an increase of 5.3 per cent over the comparable period in 1951.

Rate increase applications top $148-million

The Commission acted upon a total of $148,953,000 annually in wholesale natural gas rate increase applications filed by 30 companies during 1952. This total represents a 65 per cent increase over 1951.

Of the total acted upon in 1952, FPC suspended $148,101,000 and accepted the remaining $852,000. Of the filings suspended during 1952, increases totaling $26,463,000 were allowed to become effective, $7,750,000 were disallowed and the companies were permitted to withdraw $4,700,000. Of the remaining $109,188,000, a total of $8,586,000 became effective under bond during the year pending final disposition by the Commission, and $100,602,000 were still under suspension.

Pacific Northwest Pipeline has new application

Permission has been granted for Pacific Northwest Pipeline Corp. to file a third substitute application in connection with its plan to construct a transmission system extending from the San Juan Basin in New Mexico and Colorado to market areas in the Pacific Northwest.

Pacific Northwest's project, as now proposed, would include 1,466 miles of main line, 380 miles of spur or lateral lines, and 16 compressor stations with a total of 104,420 horsepower. The project, which would have a capacity of 343 MMcf per day, is estimated to cost $186,000,000 including $2,000,000 for working capital.

The company proposes to serve markets in Washington, northern Oregon, Idaho, Utah, Wyoming and Colorado, and also to sell gas to Colorado Interstate Gas Company. Proposed direct industrial customers include the Atomic Energy Commission's plant at Hanford, Wash.

Trans-Northwest files another application

Trans-Northwest Gas, Inc., which already has asked the Commission for authority to import and export natural gas from and to Canada, has now filed an application requesting a certificate for the construction and operation of a pipeline system to serve markets in eastern Washington and northern Idaho.

The proposed system, estimated to cost $19,765,400, would be used to import natural gas from Canada to serve various market areas, including Spokane, Ephrata, Moses Lake, Chewelah, Colville, and the Atomic Energy Commission's plant at Hanford, all in Washington; and Coeur d'Alene, Kellogg, and Wallace, in Idaho. The company also proposes to export natural gas back into Canada for service to Trail, British Columbia.

Trans-Northwest would purchase its supply of gas from Westcoast Transmission Company, Limited, at a point on the U.S.-Canadian border and would sell gas by export to Inland Natural Gas Co., Ltd. Westcoast Transmission would transport the gas from reserves in the northern areas of Alberta and British Columbia.

The application says that the facilities for importing gas would have a capacity of about 105 MMcf per day, while the export facilities would have a capacity of 10 MMcf daily.

The new certificate application has been consolidated with the hearings on Trans-Northwest's previous applications for authority to import and export gas, and for a Presidential permit covering the facilities at the International Boundary.

El Paso applies for 400 MMcf project

El Paso Natural Gas Company has applied for authority to construct new facilities which would carry an additional 400 MMcf per day from points in west Texas, southeast New Mexico and the San Juan Basin area of northwest New Mexico for delivery to customers in New Mexico, Texas, Arizona and California.

The project, estimated to cost $175,250,000, will include a total of 1,778 miles of pipeline and 161,860 compressor horsepower capacity. The proposed new facilities would permit the delivery of an additional 300 MMcf per day from the Permian Basin in southeast New Mexico and west Texas, and an additional 100 MMcf daily from the San Juan Basin in northwest New Mexico and southwest Colorado.

Out of the 300 MMcf from the Permian Basin, 100 MMcf would be for use jointly by Southern California Gas Company and Southern Counties Gas Company of California; 100 MMcf for Pacific Gas and Electric Company, and 100 MMcf for El Paso's customers in west Texas, New Mexico and Arizona. The additional 100 MMcf from the San Juan Basin would be divided, with 50 MMcf for Southern California and Southern Counties, and 50 MMcf for Pacific Gas and Electric. All deliveries to the three California companies would be made at the Arizona-California border.

Tennessee wants to up delivery to Northeastern

Tennessee Gas Transmission Company has asked the Commission for authority to increase its daily deliveries of natural gas to Northeastern Gas Transmission Company from the presently authorized 220 MMcf per day to 433 MMcf.

Tennessee plans to transport the increased quantity of gas through its presently authorized facilities and does not propose any additional construction or acquisition of pipeline facilities in connection with the application. No additional service to existing markets, other than Northeastern, or service to new markets is proposed.

The additional gas would be used by Northeastern to meet the requirements of several markets in New England which it is seeking authority to serve. Hearings on Northeastern's application to serve these additional markets are now in progress.

United Gas Pipe Line allowed new rates

Upon application filed by the company, an order has been issued making effective, as of January 3, a suspended $9,500,000 wholesale natural gas rate increase by United Gas Pipe Line Company, subject to the posting of a $950,000 bond and subject to the refund of any amounts subsequently disallowed by FPC.

United's increased rates affect customer companies which serve areas in the Midwest, South and East, and include Texas Eastern Transmission Corporation, Mississippi River Fuel Corporation, Southern Natural Gas Company, Texas Gas Transmission Corporation, and Tennessee Gas Transmission Company.

Rate increase for Texas Gas Transmission

A suspended $10,500,000 annual wholesale natural gas rate increase by Texas Gas Transmission Corporation has been made effective upon application by the company as of January 8 subject to posting a $1,000,000 bond with the Commission and subject to refund of any amounts subsequently disallowed.

The increased rates affect utility customers of Texas Gas in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Illinois, Indiana and Ohio.

Permian and Northern Natural plan new pipeline

Permian Basin Pipeline Company and Northern Natural Gas Company have submitted revised plans in connection with their proposals for Permian to build a pipeline system in Texas and New Mexico for the transportation of 300 MMcf per day, and for Northern to increase its system capacity for the receipt of this same amount of gas. The amended applications filed by the two companies reduce the amount of construction and the cost of both projects, but provide for the delivery of the same volumes of gas as originally proposed.

Permian now plans to construct a total of 163 miles of pipeline and 66,000 hp in compressor units in Texas and New Mexico at a total estimated cost of $40,269,000.

Under the new proposal, Permian will deliver the entire volume of gas to El Paso Natural Gas Company at an interconnection in Yoakum County, Tex., and El Paso will then deliver the same quantities of gas back to Permian at a point in Moore County, Tex. Permian will deliver this gas to Northern at Dumas, Tex.

Northern's amended application includes the proposed construction of about 425 miles of main pipeline, 62,400 hp in compressor capacity, and numerous branch lines and branch line additions. Estimated cost is $66,248,000.

Both the Permian and Northern projects are to be carried out over a two-year period, with 200 MMcf per day to be delivered the first year and the full 300 MMcf in the second year. The same volumes would be delivered to and by El Paso.

Gulf Interstate hearing next month

Hearings will commence March 2 on an application by Gulf Interstate Gas Co., proposing construction of an 860-mile pipeline extending from southern Louisiana to northeastern Kentucky. The proposed project, estimated to cost about $127,887,000, would be used to transport 375 MMcf a day for the account of United Fuel Gas Co.

Fred C. Ambruster

Fred C. Armbruster, gas operations manager for Central Illinois Public Service Company, died January 19, at the age of 63.

Mr. Armbruster also served for sixteen years as gas consultant for Middle West Service Company, Chicago.

He was born at Rochester, N. Y., and was graduated from Rochester Institute of Technology, with a degree in mechanical engineering. For fifteen years he was employed by gas utilities in Virginia, North Carolina, Louisiana and Texas. Among the positions he held were: vice president and general manager of Southern Cities Distributing Company, Shreveport; vice president and general manager of Peoples' Service Company, Port Arthur, Tex.; and general superintendent of Southwestern Gas and Electric Company, Shreveport.

After service with these companies, he entered the employ of Middle West Service Company. He became manager of gas operations for Central Illinois Public Service Company on February 7, 1949, and held that position until his death.

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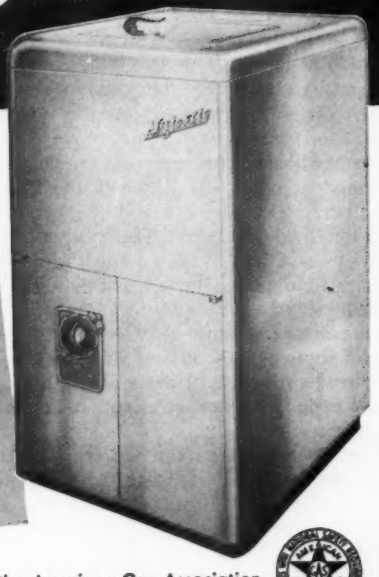

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The Majestic Co., Inc.
420-A Erie Street Huntington, Indiana

Underground Gas Storage Will Be Adjacent to Chicago Area

(Continued from page 19)

panies the right of eminent domain for storage fields meeting the requirements stipulated by the bill. The law permits, upon certification of a storage project by the Illinois Commerce Commission, condemnation proceedings to obtain necessary property rights when they cannot be obtained otherwise through friendly negotiations.

An application for approval of the project under this act was filed with the Illinois Commerce Commission and the approval was obtained last May. The storage company has obtained from practically all land owners in the area option agreements for use of the underground zones. Only in the few cases where there is diversified ownership of some parcels of land will it be necessary to resort to use of the eminent domain law in order that storage easements may be obtained.

Construction plans call for the progressive development of the field as additional blocks of house heating customers are added by the local gas distribution companies.

We plan, in the first year, to drill 25 wells into the Galesville bed for both injection and delivery of gas. As of January 1 of this year more than half of these wells have been drilled. An ultimate battery of 50 such wells is expected to be sufficient when the field reaches maximum operation. Wells will be completed with strings of 8 and ⅝-inch diameter steel casing, with larger pipe used to protect fresh water horizons in the upper formations. All casing will be cemented from top to bottom so fresh water sands and all other porous zones will be properly protected.

There will also be installed a system of gathering lines connected to a centrally-located compressor station and dehydration plant. The dehydration plant will be necessary because the gas, even though dry when injected, will be in contact with water in the reservoir and must be dried when withdrawn for use.

Compressor station piping will be installed so the station can pump gas into storage or from storage to the pipelines feeding the market area.

Plans and costs

For the first phases of the field's operation, the compressor station will be powered by five 2,000-horsepower gas-driven compressor engines, and its design will permit the addition of more compressors as the demand for storage gas increases.

A 30-inch diameter transmission line, seventeen miles long, to feed natural gas from the main line of the Texas Illinois pipeline system to the storage field has been laid. Although this line will be used to transmit gas both into and out of storage in the first year, it will be used only to feed gas into storage after another 30-inch diameter line is built from the field to Joliet to carry gas out of storage to the pipeline terminals. We plan to build the Herscher-to-Joliet out-going line in 1954, and it is anticipated that later we will require a second 30-inch pipeline from the field to Joliet, or to some other point in the market area.

Plans call for the first gas to be injected in the spring of this year, and for some gas to be withdrawn for use in the heating season of 1953-1954, although this may not permit the addition of new house heating customers at that time.

It is estimated that for initial operation, the project will cost approximately $17,000,000 including the cost of initial cushion gas and that an investment of about $50,000,000 will be required to bring the field up to full capacity. The project to date has cost approximately $5,550,000.

Equivalent of three pipelines

One can readily appreciate the worth of the Herscher field when we recall that at top capacity it will match the effectiveness, from the standpoint of peak-day deliverability, of three new major pipeline systems which would cost more than $550,000,000 to build. Any such investment would be highly questionable, of course, because it would require the customer to pay a prohibitive price for every therm of heating gas he might use.

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Bacterial Attack is Serious Cause of Corrosion

(Continued from page 31)

polarizing agents. Bacterial corrosion therefore can be said to be a *microbiological electrochemical mechanism of corrosion.*

Bacterial corrosion is by no means limited to Holland. Subsequent investigations have revealed a world-wide distribution of the sulfate-reducing bacteria and their action on buried metals.

Research and application interest in bacterial corrosion is particularly far advanced in England. A recent London dispatch described the finding of iron knives and hobnails in a perfect state of preservation, at diggings near an ancient Roman city in the vicinity of York. For about 2,000 years these ferrous items resisted corrosion. A search is being made for the inhibitory substance in the soil that arrested bacterial activity so that this discovery may be applied to present day underground pipelines and other buried fixtures.

Evidence on gas lines

Around 1940, comprehensive corrosion surveys along gas pipelines in the eastern United States demonstrated much evidence of bacterial corrosion. Less frequent reference to this type of corrosion is found from the West and practically none from the South. This, however, should not be interpreted as indicating that these regions are free of this form of corrosion. Intensive studies in the New York metropolitan area have given abundant evidence of bacterial corrosion. During World War II, a government agency investigated corrosion of marine installations along the Eastern Seaboard by sulfate-reducing bacteria.

The corrosive attack on steel and cast iron differs. With steel the characteristic effect is pitting. When the conditions are severe the pits are formed close together and fuse to corrode large areas. At times a hard black crust forms but beneath there is a soft, graphite-like paste. The latter is generally black but it may contain a thin white layer of ferrous hydrate. The corrosion products are loosely attached and when wiped off, the metal surface is bright and shining without a protective surface film. In contact with air such surfaces rust rapidly.

With cast iron pipes a layer of porous, soft corrosion products forms. This is rich in graphite and ferrous sulfide is always present. These corrosion products are not adherent but are porous and may contain an admixture of soil particles. Removal of the corrosion products leaves the metal surface in a bright and silvery state. The corrosion products are rapidly oxidized when exposed to air.

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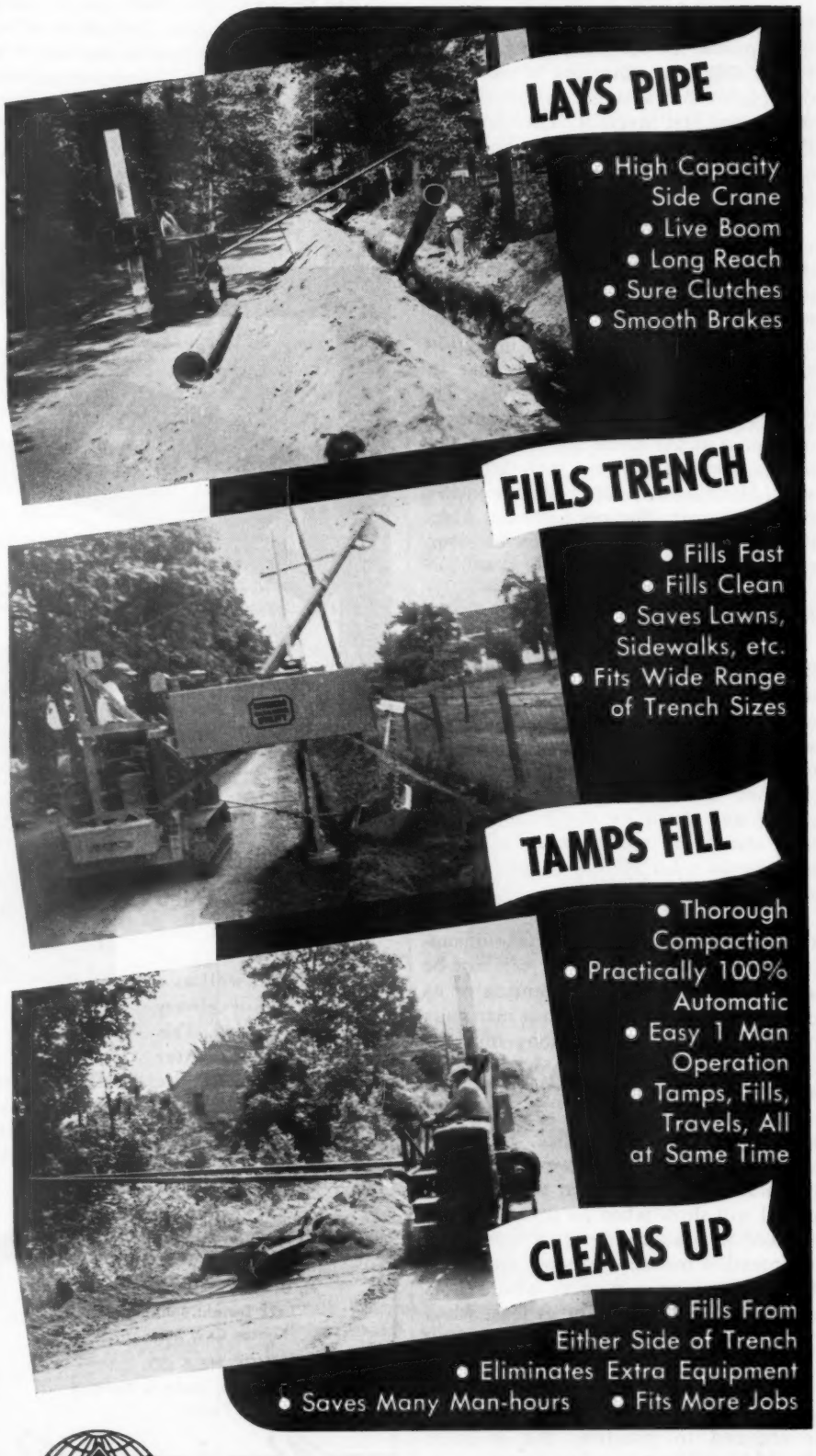
with just 1 man



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Inventors Urged to Study and Follow Patent Requirements

(Continued from page 21)

ing a patent for the same thing, but the Patent Office is authorized to issue only one patent for a single invention, and that to the first inventor. Therefore, the Patent Office sets up what is known as an interference proceeding to determine which claimant is first.

An interference can become highly involved and technical. It is far beyond the scope of this article to discuss the proceedings that are followed. It is sufficient to say that the Patent Office inquires into the history of the invention, and determines who was the first inventor and issues the patent to him. The history of an invention then becomes as important as the invention itself in helping an inventor to prove that the patent should be issued to him rather than to a rival applicant. The necessity for keeping adequate records cannot be overemphasized.

Records are vital

Records of the invention include the first sketch and the first description of it, even though they are highly diagrammatic. Any subsequent sketches or descriptions showing changes or further developments should also be kept. The sketches and descriptions should be *signed and dated by the inventor, and they should be witnessed by someone who knows what they mean and understands them.*

It has been repeatedly held by the Patent Office and courts that the unsupported word of an inventor will not be accepted as proof of an invention or its date. No matter how honest a man may be, his records and testimony must be corroborated by someone who knows and understands what was done.

Models are no longer generally required by the Patent Office. In an interference proceeding, however, they can be valuable to prove what was done. A model will show when an invention was reduced to practice, and if it worked in its intended manner. Models must also be identified by a witness who knows when they were made, or at least when he first saw them, and can describe how they worked.

Between the time that an invention was first conceived and the time that it is reduced to practice, the inventor should be diligent in trying to perfect it. In order to be entitled to a patent, the first inventor must have been diligently trying to perfect his invention before a second inventor of the same thing entered the field. Records kept to show what was being done during the time intervening between the conception of the invention and its reduction to practice or the filing of an application are also important.

There are many other things that should be considered when it is actually decided that a patent application is to be filed. These can best be decided in a particular case by a competent patent attorney. This presentation, however, will give some idea of who is entitled to a patent, and what it is advisable to do when working on the development of some apparatus or process.

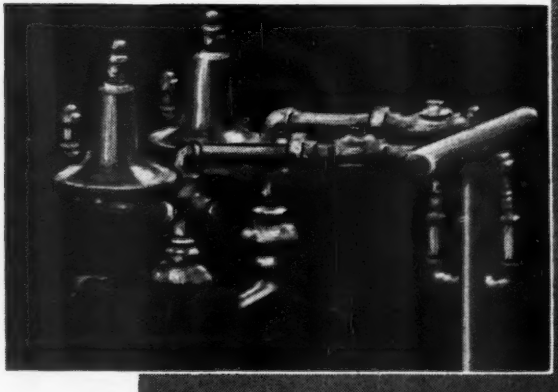
Servel Promotes Two in Sales Div.

Two promotions in the sales division of Servel, Inc. were announced recently by James F. Donnelly, vice president in charge of sales.

Donald R. Meckstroth, formerly director of marketing services, becomes manager of sales operations, and Robert B. Robinson, formerly sales research manager, succeeds Mr. Meckstroth.

Mr. Meckstroth joined Servel in 1941 as a sales cadet and became director of marketing services in January, 1951. Mr. Robinson came to Servel in 1947 as sales research representative and was made sales research manager in January, 1951.

A WIDER RANGE
... of Delivery Pressure Control



REYNOLDS HIGH PRESSURE LINE REGULATORS

in parallel hookup have an increased range of capacity as well as a wider range of delivery pressure control. This also provides greater margin for emergencies. On inlet pressure the range is up to 650 pounds. For outlet pressure, this unit assures absolutely accurate and dependable control from 2 to 100 pounds. This variance in outlet pressure is made by use of different sizes of diaphram cases and further flexibility in the spring type is possible by use of different strengthr springs.

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GAS CONTROL SINCE 1892

News of the Gas Industry

NYS—Peoples Natural Elect TopExecs

Fenton H. Finn has been elected president of New York State Natural Gas Corporation, the company has announced. Mr.

Fenton H. Finn

John J. Jacob, Jr.

Finn was previously vice president and system geologist for all Consolidated Natural Gas Company subsidiaries.

He served as a geologist for both Peoples and New York State Natural during 1934-36; was appointed chief geologist for the two companies in 1936; and, in 1943, was named system geologist.

Mr. Finn was elected Vice President of New York State Natural in January, 1951.

He is currently chairman of the underground gas storage committee of American Gas Association.

John J. Jacob, Jr. has been elected executive vice president of Peoples Natural Gas Company.

Mr. Jacob began his 30-year term of service with the company in 1922 as a civil engineer and in 1936 was appointed chief civil engineer.

He was elected a member of Peoples' board of directors in 1938, executive assistant to the president in 1939, and vice president and assistant manager of Peoples and New York State Natural Gas Corporation in October, 1942.

Mr. Jacob was president of the Natural Gas Men's Association of Western Pennsylvania in 1951.

Long Island Lighting Ups Three

The directors of Long Island Lighting Company have elected Errol W. Doebler as president. Mr. Doebler succeeds Edward F. Barrett, who was elevated to chairman of the board.

Edward C. Duffy, formerly assistant vice-president in charge of electric operations, was elected operating vice-president to succeed Mr. Doebler in that position.

Texas-Ohio Defended by Ohio PUC

The Public Utilities Commission of Ohio claims Federal Power Commission did not follow the Natural Gas Act, in exceptions to FPC orders denying the Texas-Ohio Gas Company authority to build a $184,000,000 natural gas pipeline from the Rio Grande River in Texas to Lancaster, O.

FPC denied the company's application, on November 7, then, on December 31, said the original order was tentative, not final.

The Ohio Commission said "The effect of said Federal Power Commission order . . . would be to . . . deny to the Public Utilities Commission of Ohio the right to review by the Court of Appeals. . . ."

PUCO has intervened on the behalf of Texas-Ohio in its fight to build a line which would bring 480 MMcf of gas daily into Ohio.

Foxboro Opens Kansas Branch

The Foxboro Company has opened a new branch office at Wichita to serve instrument users in the Kansas area. The new branch brings the Foxboro total to 42 offices within the United States, reflecting the growing demand for instrument engineering in industrial processing.

Appointed resident engineer at the Wichita office is Mr. Dale G. Hugley, who moves to his new assignment after several years of service with the Tulsa branch as Industrial Engineer.

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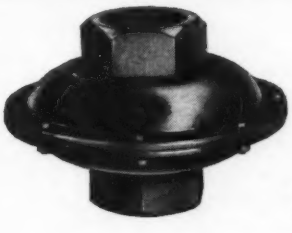


VERTICAL TYPE SHOWN

Eliminate Air In Gas Lines With

NORWALK DIAPHRAGM TYPE CHECK VALVES

Vertical Type in Sizes ⅜" thru 6"

Horizontal Type in Sizes ½" thru 6"

Norwalk Diaphragm Type Check Valves, both Vertical and Horizontal, provide positive check against reverse flow of either gas or air. Rugged construction will stand back pressures to 50 lbs. Soft seat disc will seat freely when gas flows in desired direction or will seat tightly on equalised or back pressure. Valves for higher pressures supplied on special order.

NORWALK VALVE COMPANY

South Norwalk, Conn.

IGT Fellowship Program Enlarged

Institute of Gas Technology, Chicago, announces the availability of fifteen fellowships for 1953, leading to the degrees of master of science in mechanical engineering or chemical engineering, or master of gas technology and doctor of philosophy.

The Master of Science curricula are editions which will accelerate the fellowship program to enable the earning of a Master's degree in about 15 months instead of two years, still required for the master of gas technology.

The IGT fellowship program was established to train personnel at the graduate level for the gas industry.

To further this program, the Gas Industry provided the Institute with its modern building in Technology Center, Chicago. Far-sighted members of the Industry furnished the educational and research facilities, and assumed financial responsibility for the Fellows' tuition, fees, stipend and summer training.

This outstanding example of free enterprise in action enables the Institute to offer to young men an unusual opportunity to prepare for a successful and remunerative career in a steadily-growing nationwide public service industry.

Instruction in gas technology is offered by members of the research staff; each man teaches a maximum of one course per semester. This provision insures instruction at the professional engineer level, incorporating current research and development with accepted fundamentals.

Instruction in other subjects is given in classes of the Graduate School of Illinois Institute of Technology, which grants the degrees under these fellowships.

In addition to tuition and fees, fellows receive graduated stipends while in residence. In the Master's programs, Fellows currently receive $140 per month, through the completion of the thesis. Masters candidates receive $160 monthly; doctoral candidates receive larger stipends.

Applications are invited from college seniors and graduates in chemistry, physics, and chemical, mechanical, natural gas, and petroleum engineering, who are in the upper quarter of their classes. Applicants must be citizens of the United States or Canada, in good health, under 28 years of age, and have shown adaptability, cooperation, and high moral character. Only mechanical or chemical engineering graduates of accredited colleges are eligible for the fifteen months M.S. program.

Application forms may be secured by a student from his college department head or placement director; also, from personnel managers of gas companies. They are available from the director, Institute of Gas Technology, 17 W. 34 St., Chicago 16.

Foxboro Extends Montreal Plant

A new plant extension at Montreal has more than doubled the instrument manufacturing facilities in Canada of The Foxboro Company. The expansion, second in the past five years, matches the original building in arrangement and appearance, with the new section adding 23,000 sq. ft. of factory space for production, assembly, storage, and enlargement of existing departments. An additional 5,000 sq. ft. on a lower level provides a new cafeteria for employees and training school facilities.

Designed to meet future as well as immediate needs, the plant extension includes under-floor service ducts to eliminate overhead piping of air, water, gas and electricity; an underground switchroom and transformer station, and foundations for still another building.

Ohio PUC Reorganizing Procedures

The Public Utilities Commission of Ohio predicted last month there would be further reorganization of PUCO. Commissioner Ray O. Martin said a "constant cycle" of reorganization orders would be issued as new procedural steps are worked out.

A three-fold goal was sought when PUCO issued two recent orders to speed the handling of formal cases: to help PUCO function along the businesslike lines adopted by top industry; to place more responsibility on staff members and encourage them to use more initiative in their work; and to weed out useless activities which have grown up over a number of years.

The Commission decided there should be no more informal talks on any matter after it had been assigned a formal docket number unless both parties and all intervenors in the matter had been notified of the conference.

EXPLORATION-PRODUCTION FOR OIL AND GAS AT NEW HIGHS

More crude oil, natural gas liquids, natural gas, motor fuel and distillate fuel oil were produced during 1952 than in any other twelve-month period, according to Frank M. Porter, president, American Petroleum Institute, in his year-end report of the oil industry's accomplishments and plans for further progress.

The oil and gas industry carried out the most extensive drilling program in history, to make sure that the supply of petroleum will be maintained in the future, despite higher costs and shortages of critical materials, particularly oil country tubular goods.

The record of wells completed within the United States shows that while the total was greater than the previous-high in 1951, gas wells and service wells account for the only substantial increases. The number of oil wells was down and there was a considerable increase in the number of dry holes.

The wells completed during the most recent five years are:

	1952*	1951	1950	1949	1948
	(thousands of wells)				
Total	46.8	44.5	43.3	39.0	39.6
Gas	3.3	3.0	2.8	2.9	2.9
Oil	24.0	23.4	24.4	21.9	22.3
Service	1.4	1.3	1.2	1.4	2.3
Dry	17.9	16.7	14.8	12.8	12.1

*Estimated

The production record for the year was up to new highs as shown in this five-year summary:

	1952*	1951	1950	1949	1948
Nat. gas *(billion cf)*	10.5	9.7	8.4	7.5	7.2
Crude oil *(million bbl)*	2.3	2.2	1.9	1.8	2.0
Nat. gas liq. *(million bbl)*	221.1	205.7	182.1	157.2	147.0

*Estimated

Refinery capacity, throughout the industry, has now been increased to 7,613,000 bbl per day. Last year, 2,436-million bbl of crude oil were processed.

CRUSE-KEMPER COMPANY

AMBLER, PENNA.

FIFTY YEARS OF SOUND

STEEL PLATE CONSTRUCTION

GAS HOLDERS PURIFIERS

Gas Holder Repairs Gas Holder Inspection

Milwaukee Station Designs Consider Eyes and Ears of Public

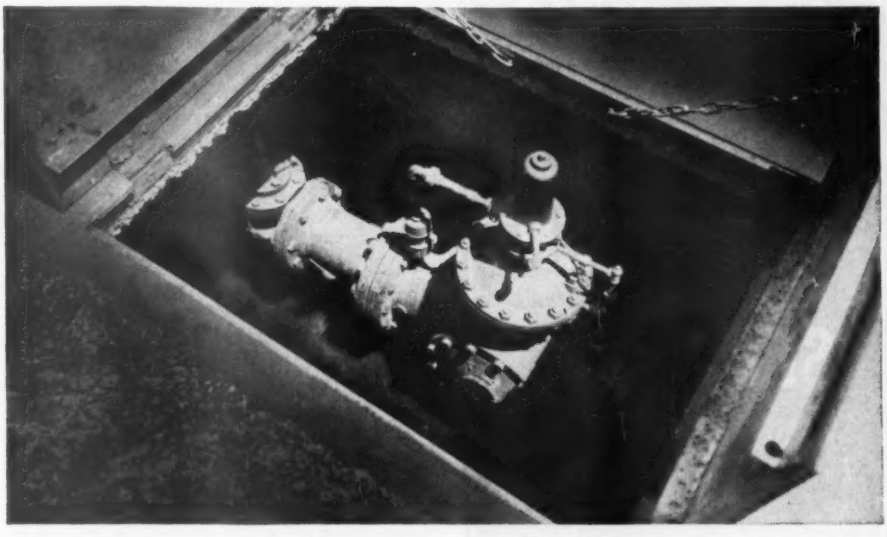
(Continued from page 17)

tions which combine second- and third-stage regulation, and three stations that are exclusively for third-stage regulation. Steel pipe ranging from 12- to 24-inches is used in this network to the regulator stations.

During second-stage regulation, pressure is reduced from 140 psi to lower pressures which range from 25 to 40 psi. Third-stage regulation reduces the pressure to 7 or 8 psi.

From the regulator stations, gas is distributed to the company's service area. Further pressure reduction is made in more than 100 low pressure distribution pits, distributed around the system, to get the 7-inch wc pressure for delivery to consumers.

The equipment used in these regulator stations are Rockwell high pressure or low pressure balance valve regulators and Nordstrom valves. At some isolated points in the system, Rockwell pilot loading system is being installed now in the low pressure regulator pits to provide a greater outlet pressure range as well as a closer control at the higher outlet pressures. Most of the valves in the system are Nordstroms and these are being installed as replacements are made.



Close-up of emergency by-pass pit outside the Milwaukee Gas Light Company's regulator stations.

I. L. Muntz is Rochester Council Pres.

Miss Irene L. Muntz, manager, home service and home lighting department, Rochester Gas & Electric Corporation, was elected president of the Rochester Safety Council for 1953. This is the first time that a woman has been elected as presiding officer of the Safety Council.

Cities Service Plans LP Storage

Plans for an LP gas storage terminal near Hutchison, Kans., have been indicated by Cities Service Oil Co. It will include underground capacity for about 4,000,000 gallons. The underground installation will be washed out of salt formations underlying acreage recently leased by Cities Service.

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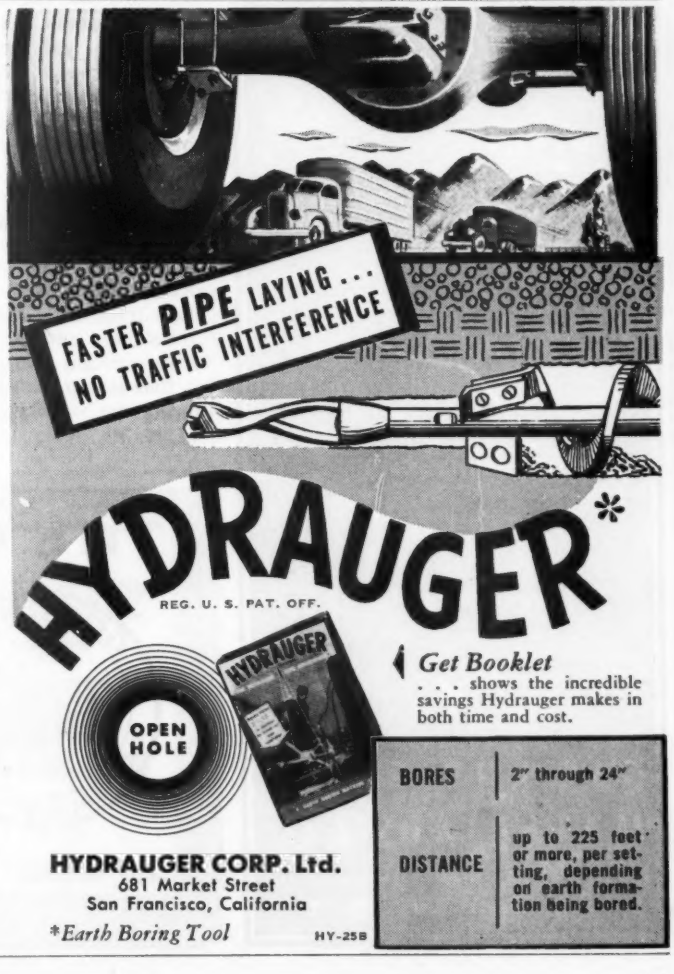

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NEW BULLETINS

TAPAX MANHOLE CUSHION. This bulletin describes a resilient non-adhesive cushion that acts as a seat for a manhole cover. The body of the cushion is composed of fibre asbestos and an interweaving of bronze wire mesh which are processed to permit their conforming to the irregularities of both the frame and the cover. An adhesive compound serves to bind the cushion to the seating flange of the manhole frame and allows the cover to be removed and replaced as required without disturbing the cushion. After a short time in use the cushion becomes a fixed gasket, thoroughly impregnated with the weather-proof adhesive which protects it against the elements and seals the cover in place.

Joseph G. Pollard Co., Inc., New Hyde Park, N. Y.

DISPLACEMENT METERS. This bulletin contains information on meters for measuring gases of any type, and in volume from 4 Mcf to 1MMcf. In addition to detailed descriptions and illustrations of meters of various types, the bulletin offers a useful selection table to determine the meter required for any load, whether at standard or variable conditions of temperature and pressure.

Bulletin M-152 Pp. 16. Roots-Connersville Blower, Dresser Industries, Inc., Connersville, Ind.

HAUCK LOW PRESSURE AIR-GAS PROPORTIONAL MIXERS. Designed to be of interest to users of gas fired industrial equipment such as furnaces, ovens, kiln and driers, this bulletin describes the simultaneous controlling and accurate proportioning of air and gas with a single control valve for manual or automatic operation. According to the bulletin a consistent air-gas ratio is maintained over the entire range of the mixer capacity, and the self-locking feature of the mixer control adjustment eliminates changing of mixture caused by hand-locking adjustments. Mixer capacity tables are given for 5 different kinds of gases and for 8 air pressure ratings.

Bulletin 805A. Pp. 12. Hauck Manufacturing Co., 124-136 Tenth St., Brooklyn 15, N. Y.

CONTINUOUS ROLLER HEARTH FURNACES. Roller Hearth furnaces are described in this bulletin, and it features the three principal design types—controlled atmosphere, direct-fired, and convection heated. The bulletin covers typical process applications in both the ferrous and non-ferrous fields. Related prepared gas atmosphere generators are shown and a chart of prepared atmosphere compositions is included.

Bulletin SC-160. Pp. 4. Surface Combustion Corp., Toledo, O.

WHERE TO USE COAL TAR PROTECTION. This bulletin presents practical suggestions to combat corrosion. It includes details on how and where coal tar protection can be used to best advantage and offers case histories to show how corrosive problems have been overcome in many fields.

Pp. 8. Tapecoat Co., Evanston, Ill.

TRANTEX TAPE. This cold-applied pipeline wrap developed for corrosion protection for underground gas and oil pipelines and overhead piping is described in this bulletin. It stresses the important advantages of the tape as a pipeline protection material, and illustrates where and how the material can provide economies in specific field applications. Reference tables on the tape's properties and coverage data are included.

Pp. 6. Johns-Mansville, 22 East 40th St., New York 16, N. Y.

TAR BASE PROTECTIVE COATING. Here are a series of five bulletins describing tar base protective coatings. One bulletin gives specifications, uses and methods of applying all four coatings in the series. Other bulletins give detailed information on each of the different coatings. The coatings in the series range from heavy duty for severest corrosive conditions to a long-lasting coating for water piping and tank interiors.

Protective Coatings Division, Pittsburgh Coke & Chemical Co., Room 1953, Grant Building, Pittsburgh 19, Pa.

ECLIPSE GAS-FIRED POT FURNACES. This bulletin describes rectangular and circular salt pot furnaces which are designed for production hardening and drawing operations with lead or heat-treating salts. These furnaces are built in a wide variety of sizes, for temperatures from 350° to 1650°F.

Bulletin D-50. Pp. 8. Eclipse Fuel Engineering Co., Rockford, Ill.

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EQUITABLE GAS COMPANY REGULATOR FORUM AT CHAPLIN-FULTON MANUFACTURING COMPANY PLANT

The Equitable Gas Company of Pittsburgh, in cooperation with the Chaplin-Fulton Manufacturing Company, recently held an all-day forum on pressure regulation, safety and control problems. The conference was held at the new plant of the Chaplin-Fulton Company, and was attended by engineers, superintendents, maintenance men, and others concerned with pressure regulation.

Forum subjects discussed included those on regulation theory, construction, performance, and maintenance. A complete shop inspection tour was made including a visit to the new Chaplin-Fulton high pressure laboratory.

MEN AT WORK

G. GRAYDON CURTIS was appointed assistant general sales manager, *Rochester Gas and Electric Co.*

ALFRED H. DOUD has become assistant director of public relations, *Rochester Gas and Electric Co.*

LEONARD E. FEITT has joined as sales-service engineer, *Gustin-Bacon Mfg. Co.*

JOHN W. FREUND was named Detroit sales engineer, metal products division, *Koppers Co., Inc.*

BARTH GILCRIST has been named division manager at Philadelphia, *Gustin-Bacon Mfg. Co.*

SEYMOUR W. GOERSS has been promoted to superintendent of production, for companies associated with *Republic Light, Heat and Power Co., Inc.*

H. GOTTWALD is now eastern regional sales manager and manager of New York district office, *Rockwell Manufacturing Co.*

M. F. GRACE is in charge Texas division sales, *Robertshaw-Fulton Controls Co.*

GRANGER GREEN is now manager, lake shore district, *Rochester Gas and Electric Co.*

M. J. HARPER is now a vice president, *Rockwell Manufacturing Co.*

EDWARD C. INGHRAM has been elected general superintendent, *New York State Natural Gas Corp.*

WALTER MCKIE is now general sales manager, *Rochester Gas and Electric Co.*

CHARLES A. MENGERS is now engineer of gas design, *United Engineers & Constructors Inc.*

JOHN N. MOORE, JR., has been named sales engineer, Chicago district, metal products division, *Koppers Co., Inc.*

DEWITT PIKE has been advanced to superintendent of employee relations, *Rochester Gas and Electric Co.*

G. A. PLUMMER has been appointed west Texas district manager *Lone Star Gas Co.*

ARTHUR C. RISSBERGER is now manager employee relations, *Rochester Gas and Electric Co.*

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Industry Responsibilities Shown in Recent Court Decisions

(Continued from page 22)

court said, "There is no valid distinction, between the power of a unit of a government to manufacture and sell electricity and to buy and sell natural gas. Each is a public and governmental function."

Also, this higher court held another part of the state law valid which provides that no city, or other public agency, shall operate a competing system for selling gas to consumers served by the new branch gas line.

This higher court also held that giving the board or authority power to fix the rates at which gas shall be sold to consumers does not violate any provisions of the state constitution.

Readers who are interested in the specific law laid down by this higher court should read the complete decision. It is quite lengthy but contains unusually informative and valuable legal data. The decision was rendered about two months ago. This higher court explains in detail when and under what circumstances a state law is valid under which a board or authority is empowered to purchase, distribute, and sell gas; construct installations necessary to supply gas to consumers; establish valid gas rates; and prevent competition from other suppliers of gas.

Legal nuisance

The higher courts consistently hold that a "legal nuisance" is anything that affects the normal enjoyable rights or health of citizens. According to a late higher court decision, operations causing noise may be a legal nuisance during the night, but not during the working day.

For illustration, in Rochester v. Charlotte, 114 N.Y.S. 37, it was shown that a suit was filed against a company which unloaded non-metallic materials from railroad cars of the hopper type. It was argued that the noise produced is a "public" and "legal nuisance."

"We find that the noise caused by the operation of the shake-out by day," the higher court said, "while annoying and disturbing, has not been shown to be injurious to the public health."

This court, however, rendered an injunction against unloading the cars during the hours of 6:00 P.M. to 7:00 A.M. and on Sundays.

Boy is drowned

"Is a gas company legally obligated to fence or barricade a dangerous excavation, hole or pond to protect adventurous and trespassing children?"

According to a late higher court decision the answer is no.

For example, in Holifield v. Wigdor Company, 235 S.W. (2d) 564, the testimony showed facts as follows: There was a good deal of rainfall after a pond was dug and soon the pond was "brimful of water."

One day a small boy entered the water-filled excavation and was drowned. The parents of the boy sued the company for heavy damages. In holding the latter not liable, the higher court said:

"At most, the failure to place a fence or barricade around the hole was no more than 'mere casual negligence.' "

[The basic considerations here are quite obviously well-beyond any possible court decisions and they seem to nullify the judicial opinion. ED.]

Vested rights

"When and under what circumstances can a promised pension lawfully not be paid to a retired employee of a municipal gas department?"

If a percentage of an employee's salary has been paid to the city over a period of several years and appropriated for pension purposes, the employee has vested and positive rights to receive a pension. This is so notwithstanding state and city laws are enacted to the contrary.

The courts hold that city employees are not fully compensated upon receiving their salary payments, as in addition to their salary they have "earned" certain pension benefits. While payment of pension benefits may be deferred, and payment is conditioned that the employee continue to serve the city for the period required by the statute, yet the mere fact that the pension payments are in whole or in part dependent upon certain contingencies, this fact does not prevent or destroy vested rights, and the city may not deny or impair the contingent liability any more than it can refuse to make the salary payments which are immediately due. Hence, the city cannot refuse pension benefits after all the contingencies have happened, and further it cannot do so at any time after a contractual duty to make salary payments has arisen, since a part of the compensation which the employee has earned consists of his pension rights. Other higher courts have held that if the law were not thus established, a primary object of providing pensions for governmental and municipal employees would be defeated, and which object is to induce competent persons to enter and remain in public employment. Hence, pensions cannot be denied or refused especially if the employee has paid into the pension fund a percentage of his salary.

For illustration, in Kern v. City of Long Beach, 179 Pac. (2d) 799, it was

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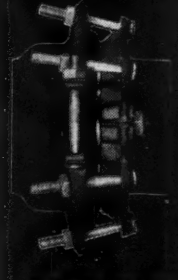

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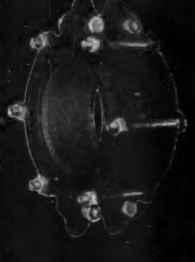

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shown that a man named Kern entered upon his duties as a member of a city department when the city's charter provided that after 20 years' aggregate service an employee on application "shall be retired and paid in equal monthly installments" a pension equal to 50 per cent of his annual salary. Two per cent of the employee's salary was deducted and paid into a pension fund.

Approximately 32 days before Kern completed the required 20 years' service, a new law was enacted which repealed the pension provisions and eliminated pensions of all persons not then eligible for retirement. Upon completion of his 20 years' service Kern requested that he be retired and paid a pension. The city rejected his application and Kern filed suit to compel payment. The testimony showed that two per cent of Kern's salary had been deducted for a pension fund over a period of almost fourteen years.

It was contended by the city that Kern did not acquire any vested right to a pension, because he did not complete the prescribed period of service prior to the time the new law was passed.

The higher court ordered the city to pay a pension to Kern, saying, "Although there may be no right to tenure, public employment gives rise to certain obligations which are protected by the contract clause of the Constitution, including the right to the payment of salary which has been earned. Since a pension right is "an integral portion of contemplated compensation" it cannot be destroyed, once it has vested, without impairing a contractual obligation. Accordingly, we conclude that petitioner (Kern) has a vested pension right and that the city, by repealing all pension provisions, has attempted to impair its contractual obligations. This it may not constitutionally do, and therefore the repeal is ineffective as to petitioner."

For comparison, see Dryden v. Board of Pension Com'rs, 6 Cal. (2d) 575. This court said, "It has been clearly held that the pension provisions of the city charter are an integral portion of the contemplated compensation set forth in the contract of employment between the city and a member of the department, and are an indispensable part of that contract, and that the right to a pension becomes a vested one upon acceptance of employment by an application."

Corporate Bond Market Expects Interest Rise

(Continued from page 23)

tions in the market pattern, but the common stock investment has been maintained at a 'norm' of 30 per cent. The University currently has raised the common stock investment ratio to 46 per cent.

As pointed out in AMERICAN GAS JOURNAL on several previous occasions, this is not a condition unique to Yale or to just a handful of universities. Rather it is an ill common to most of the country's institutions of higher learning. In fact, definite warning in this respect was voiced only recently by Dr. M. E. Sadler, president, Texas Christian University. A definite trend is taking place, he stated, toward the growth of government supported colleges at the expense of the private institutions.

The colleges do not intend to give up the ghost, according to Dr. Frank H. Sparks, president, Wabash College, but are banding together on state-wide and regional bases to meet the financial crisis co-operatively.

It seems safe to assume that one of the first steps will be to increase the ratio of common stock investment to the total as a move to bolster income from the dollars actually at work.

An even greater avenue for common stock demand is the sharply rising volume of private pension funds. According to the report of the National Planning Association prepared for the Joint Congressional Committee on the Economic Report, private pension funds in 1952 put aside between $1.8 billion and $2 billion against future payments. In all, the report said, present private pension fund reserves total around $12 billion.

But in another decade, the Association estimated, the reserves will amount to somewhere between $33 billion and $39 billion, based on present prices and including interest.

While practically none of the insured pension reserves is invested in equities, the report pointed out, "there is a growing emphasis on maximizing income and a desire to protect the fund against the effects of inflation."

Elimination of the double tax on dividend payments by corporations might go a long way toward increasing the present small direct investment of individuals in common stocks.

This double taxation is not by any means the sole reason for the small individual interest in common stocks which in the latest three months' period, as reported by the Securities and Exchange Commission, was estimated at less than $400 million. This is a small proportion of the $6.1 billion total of individual savings in the same quarter, and it is even smaller when it is considered that the $400 million sum includes the amount invested in mutual investment funds.

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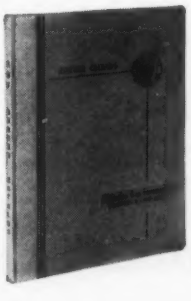

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GAS INDUSTRY CALENDAR

February

18-19 PCGA technical section, Hollywood, Cal.
25-26 PCGA sales section, Los Angeles.
27 NEGA industrial division, Hampshire House, Boston.

March

16-20 National Association of Corrosion Engineers, Hotel Sherman, Chicago.
18-19 PCGA technical section, joint conference customers service-accident prevention, Fresno, Cal.
26-27 NEGA annual meeting, Hotel Statler, Boston.
26-27 Oklahoma Utilities Association, Tulsa, Okla.
27-29 Mid-West regional gas sales conference, Edgewater Beach Hotel, Chicago.
30-Apr. 1 Mid-West Gas Assn., Broadmoor Hotel, Colorado Springs, Colo.

April

13-16 AGA distribution, motor vehicles and corrosion conference, Hotel Sherman, Chicago.
13-15 AGA industrial and commercial gas sales conference, Hotel Warwick, Philadelphia.
16-18 Florida-Georgia Gas Association, Hotel Biltmore, Palm Beach.
21-23 Southwestern measurement course, University of Oklahoma, Norman.
23-24 Indiana Gas Association convention, French Lick Springs Hotel, French Lick.
27-29 Mid-West regional gas sales conference, Edgewater Beach Hotel, Chicago.
28-29 PCGA technical section, distribution, San Jose, Cal.
29-May 1 New England hotel and restaurant show, Statler Hotel, Boston.
30-May 1 AGA transmission and storage conference, Edgewater Beach Hotel, Chicago.

May

3-8 LPGA convention and show, Conrad Hilton Hotel, Chicago.
4-5 AGA eastern natural gas regional sales conference, Wm. Penn Hotel, Pittsburgh.
4-8 AGA industrial gas school, Sheraton-Cadillac Hotel, Detroit.
10-15 National restaurant convention and exposition, Navy Pier, Chicago.
11-13 Southern Gas Assn., Jung Hotel, New Orleans.
11-15 National Fire Protection Assn., Edgewater Beach Hotel, Chicago.
12-14 Pennsylvania Gas Association convention.
20-22 GAMA annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.
25-27 AGA production and chemical conference, Hotel New Yorker, New York.
28-29 The Natural Gas and Petroleum Association of Canada, London, Ontario.

June

14-18 Canadian Gas Association, Windsor Hotel, Montreal.
22-23 Michigan Gas Association, Grand Hotel, Mackinac Island.

September

9-11 PCGA, San Francisco.
11 New Jersey Gas Association, Spring Lake, N. J.

October

19-23 National metal exposition, Public Auditorium, Cleveland.
26-29 AGA annual convention, Kiel Auditorium, St. Louis.

November

11-13 Wisconsin Utilities Association, Hotel Schroeder, Milwaukee, Wis.

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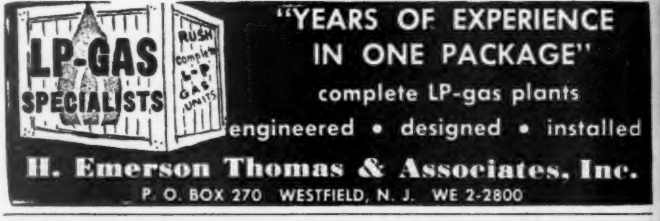
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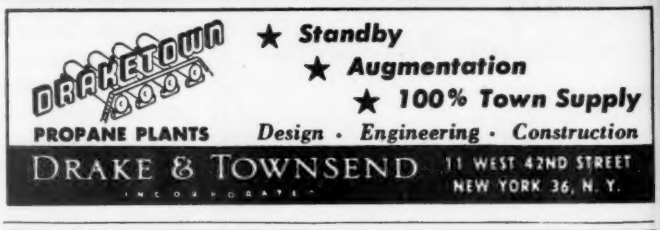

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